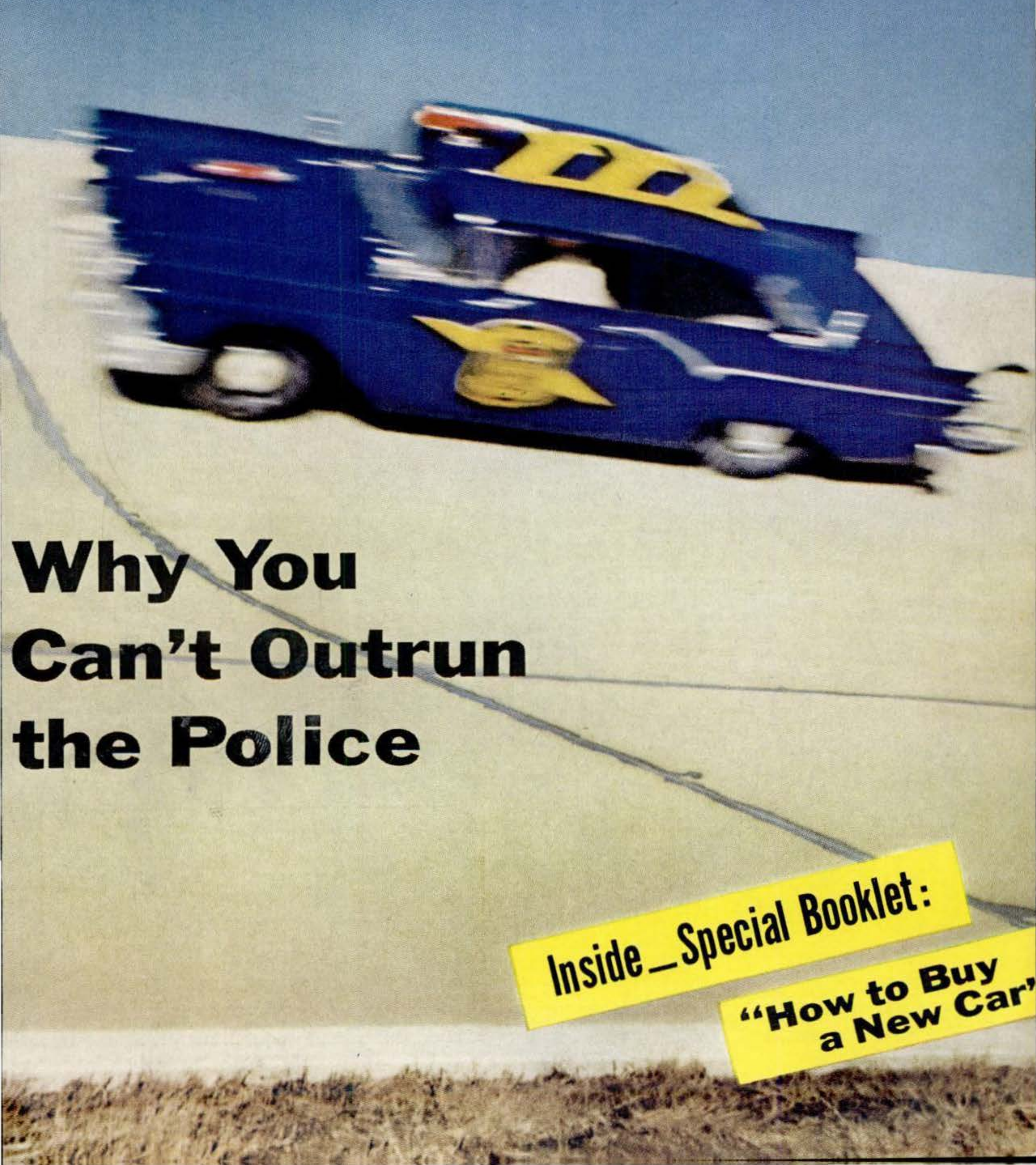
POPULAR SCIENCE

MAY · 35c Monthly



Why You Can't Outrun the Police

Inside—Special Booklet:

"How to Buy a New Car"

NOW

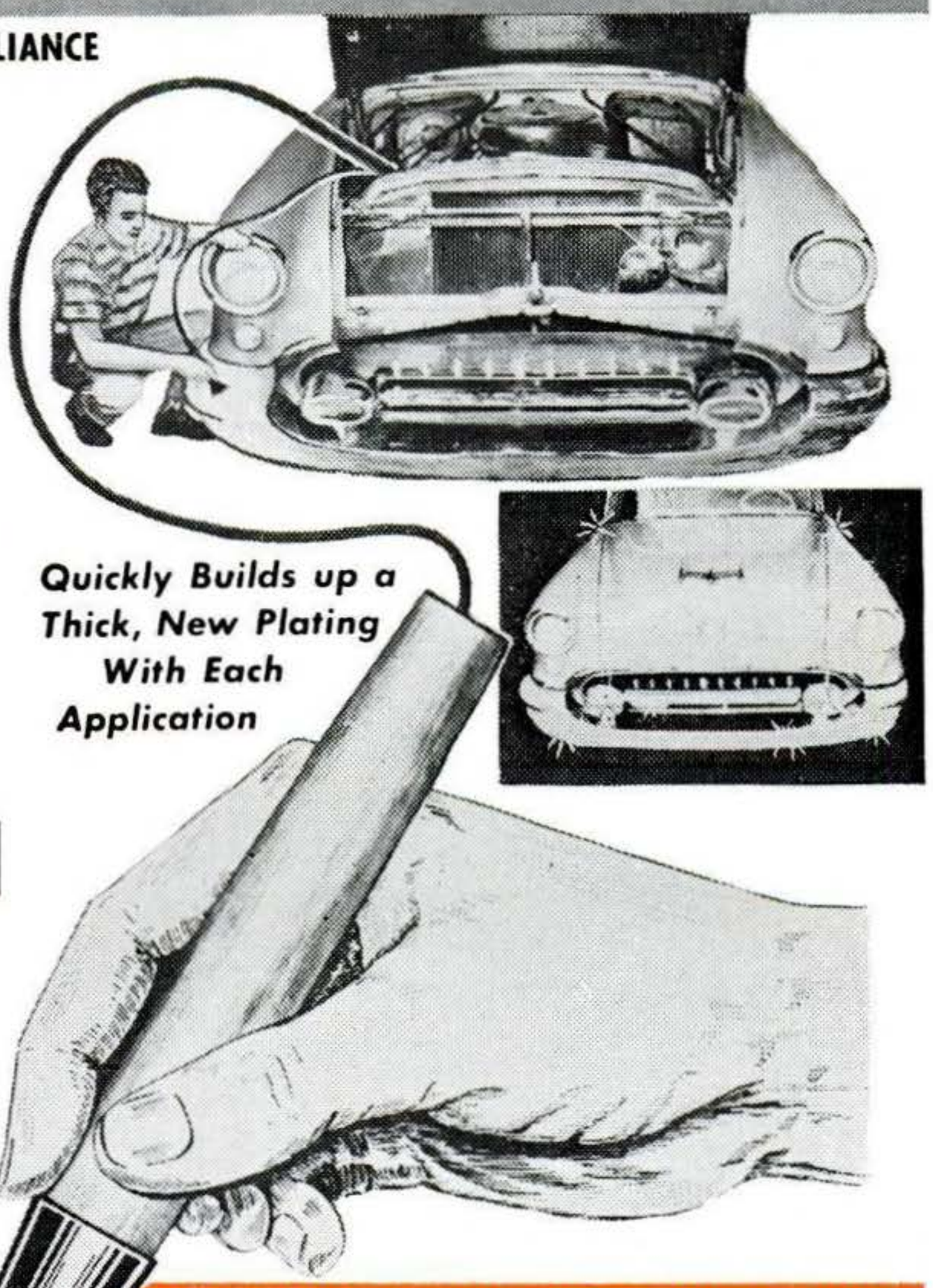
MAKE MONEY! SAVE MONEY!

Electro PLATE AUTO CHROME

with PERMANENT PLATING

A REMARKABLE NEW INVENTION
PLATES AS YOU BRUSH!

FACTORY-NEW BRILLIANCE FOR CAR CHROME!



Quickly Builds up a Thick, New Plating With Each Application

Here at last is the car-owner's answer to all chrome problems . . . a dramatic new invention called SPEEDPLATER. It actually plates NEW METAL as you brush. And the plating you apply becomes an INDESTRUCTIBLE part of the bumper, grille or trim itself. How your car will shine! You'll be mighty proud when you remove ugly rust spots and replate metal to a NEW SPARKLE . . . when you bring new, gleaming beauty to worn, dull, even blistered chrome areas of your car. This fast, sensational method of brush-plating gives FACTORY-NEW BRILLIANCE that bonds itself onto your car. It forms a hard, sparkling surface defying all elements!

BUMPERS—GRILLWORK—ALL CAR TRIM RESTORED TO NEW BRILLIANCE!

Here is how easily you REPLATE your car . . . You simply attach SPEEDPLATER'S clamps to your car's battery, then dip SPEEDPLATE Brush into the miracle solution and start plating anywhere around your car—without removing any parts. This safe, mild current WORKS FAST—yet uses less battery juice than the tiniest light on your car.

Make Big Money Plating Other Cars!

Now you can add to your income during spare-time hours . . . because 8 out of 10 cars on the road today NEED REPLATING. You can charge from $5.00 for touching-up to $50.00 for replating an entire car. It's easy and there's good money in it for you. When your neighbors see the brilliant plating on your car, they'll surely want you to do the job for them! Replate other things for profit too—faucets, home appliances, tableware, cutlery, doctors' and dentists' instruments.

READ WHAT USERS SAY!

AMAZING NEW SPEEDPLATER has already plated thousands of cars with Extraordinary Results! Here are just a few of the many unsolicited comments received from thrilled users: ". . . The outfit arrived O.K. and I must say it does everything you say it does and more . . . Thanks very much for sending me something that is really worth many times the price you charge . . ." Rev. M.D. Awtry, Naples, Fla. . . "To say I am pleased is putting it very mild. I have got more work than two of us can do . . . we had to start Booking Jobs Ahead like the family Doctor . . ." Frank Sumner, Kokomo, Ind.

CAR DEALERS & SERVICE STATIONS

Make Big Profits with Special

HEAVY-DUTY PLATING OUTFIT

FACTORY RESULTS and BIG VOLUME BUSINESS can make a TERRIFIC PROFIT FOR YOU with this Super Plating Outfit. Do your own replating in minutes without removing bumpers or grillwork! Increase the value of your used cars! Heavy-Duty Outfit includes SpeedPlater Brush with Permanent Anode, wires and clamps. Special Wheel for removing pits and rust. Buffing Wheels, Buffing Compounds. Plenty of plating solutions for dozens of cars, special solution for stripping old chrome if necessary. Electroplates on current from 12 volt battery. ENTIRE KIT COMPLETE—only $34.95. You quickly make back cost of the outfit on your very first job! Additional solutions etc. always available from us at rock-bottom prices. Heavy-Duty Outfit sold on same MONEY BACK GUARANTEE! Mail coupon now. If C.O.D., send $5 deposit.

CASH REFUND IF NOT COMPLETELY SATISFIED

MAIL COUPON NOW—YOU RISK NOTHING

If you want to put a new permanent gleam on YOUR CAR'S Bumpers, Grille, Ornament, Trim, you can do it right away and not risk a dime. If you are not satisfied with great results, it doesn't cost you a penny! Just mail coupon with only $1 deposit—then pay postman $13.95 plus postage when your kit arrives. If you send $14.95 we pay all postage charges. Either way you must be COMPLETELY SATISFIED or you may return all in 10 days for FULL CASH REFUND of purchase price. ACT NOW! HERE'S WHAT YOU GET: SPEEDPLATER Brush with Stainless Steel Permanent Anode; Wires and Clamps for battery hook-up; Enough solutions to plate several cars; Special Buffs and Buffing Compound; Special Metal Polish; Full simple instructions.

EMPIRE MERCHANDISING CO., Dept. P557
4 North 3rd Ave., Mt. Vernon, N. Y.

Please rush the electroplating kit I have checked.

- ☐ Regular SPEEDPLATE OUTFIT, $14.95 (if C.O.D. send $1 deposit).
- ☐ Heavy-Duty Service Station Outfit, $34.95 (if C.O.D. send $5 deposit).
- ☐ I enclose full price, send postpaid

I understand that I must be COMPLETELY SATISFIED or I may return kit within 10-days for immediate CASH REFUND.

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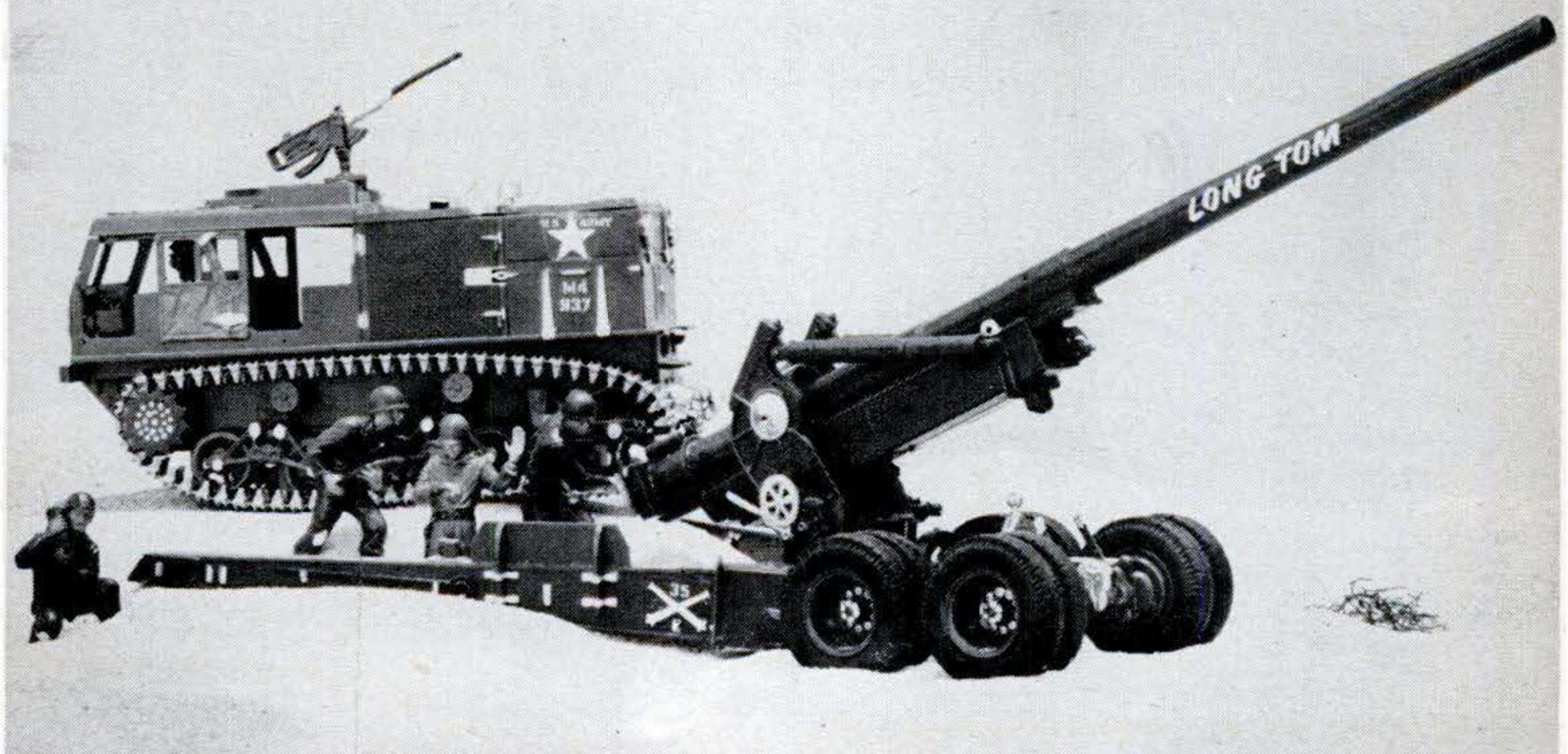
LONG ON ACTION!



"LONG TOM" GUN WITH TRACTOR AND 5-MAN CREW $1.98

155 mm. gun, towing limber, high-speed tractor all move—in new model Revell Authentic Kit scaled from Army blueprints!

This new Revell model not only looks real—it almost **acts** real. Build it yourself and see. You can pivot and swivel the 155 mm. gun barrel, roll it along on wheels, move the split trail on the gun carriage from towing to battle-ready position. Gun even has recoil action. M-4 tractor has real moving treads. It's all there—detail for detail like the heavy artillery unit that saw action on every World War II front. You put it together from precision-plastic parts with step-by-step instructions. Complete Revell Authentic Kit. **$1.98**

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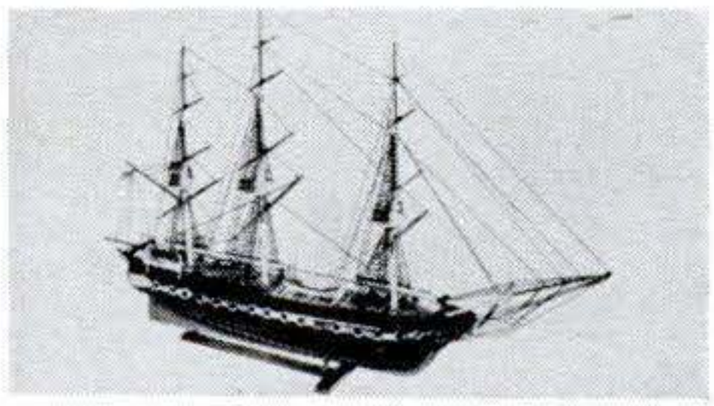

OLD IRONSIDES—Historic U. S. Frigate Constitution, reproduced in museum-perfect scale. Accurate to last details of rigging, cannon, long boats. Comes with display stand, cement, 16¾". **$2.98**

CONTINENTAL MARK II—Aristocrat of the auto world, scaled down from 218" to 6 13/16". Exact detailing, even to overhead valve V8 engine, movable hood, under-chassis. Includes 2 figures. **98¢**

Revell
Authentic Kits

Wherever hobby kits are sold.

NOW! See all the other models you can build, including 19 different ships. Send this coupon to get big 32-page Revell Collectors Catalog—only 25¢ (Stamps or Coin)

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Please check

☐ I have built plastic Kits before.

How many? _____

☐ I have never built a plastic Kit before.

My age is _____

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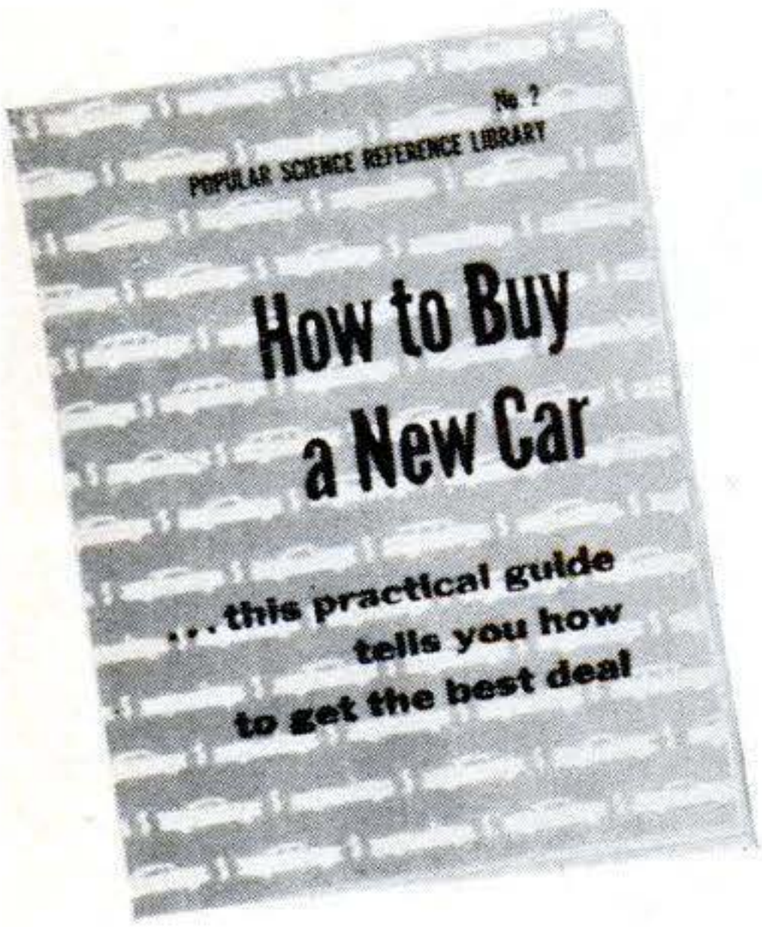
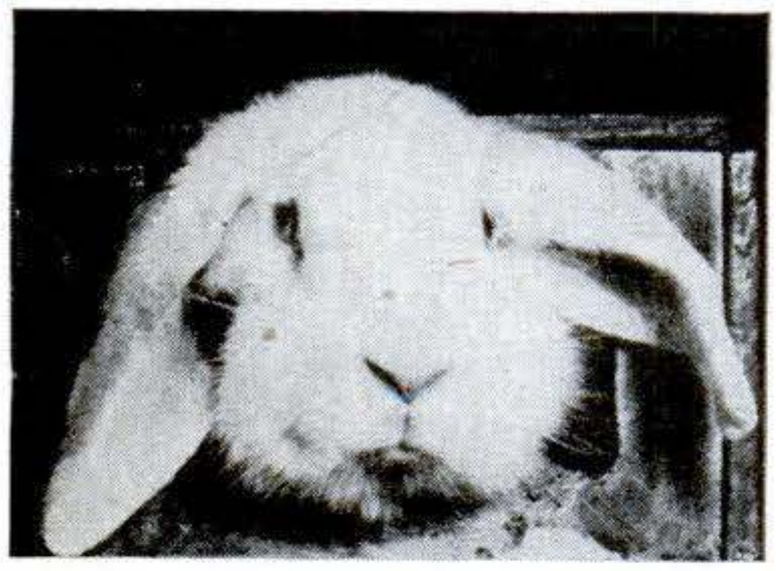
Popular Science Monthly

May, 1957





From a droopy-eared rabbit to the latest A-missile, PS brings you a roundup of science news in exciting pictures

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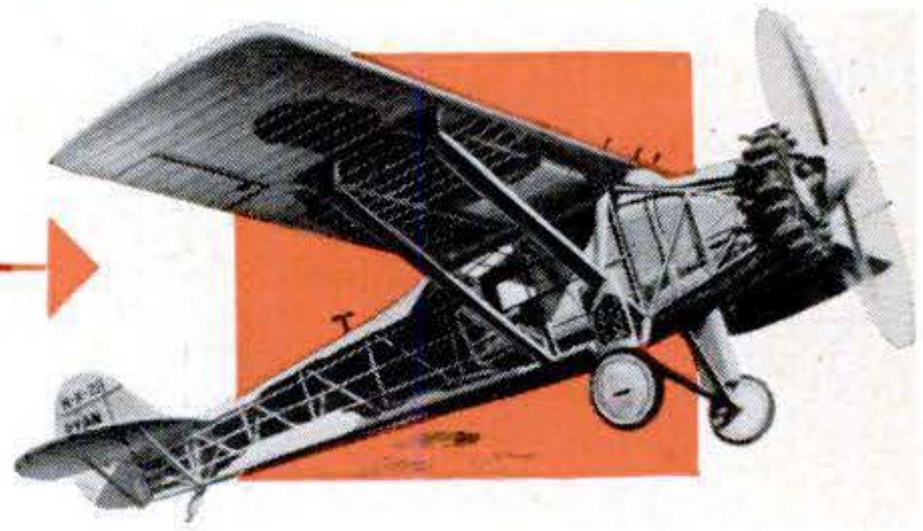

The inside story of the plane that flew into history, just 30 years ago this month

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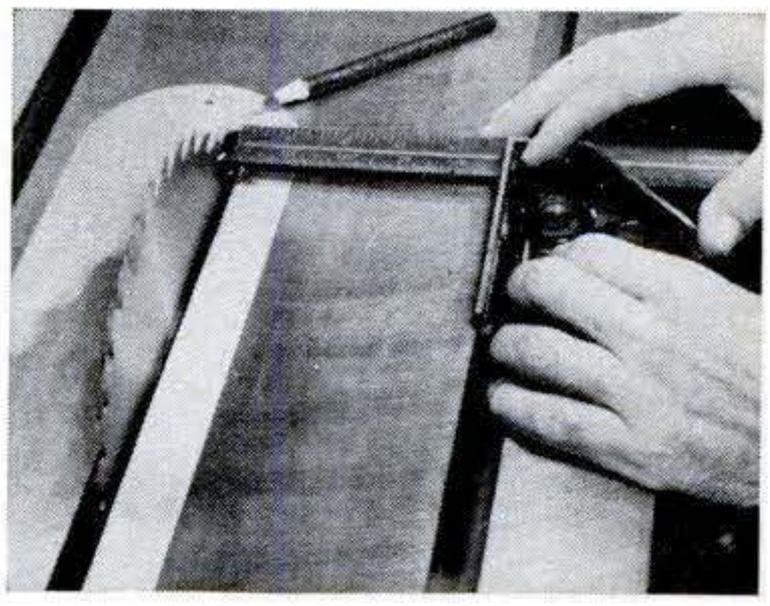

Are you getting the precision out of your table saw that was built into it? An expert tells you how

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PS Readers

TALK BACK

"Gifted Child" Draws Applause

For more than 40 years I have been a reader of magazines such as Popular Science. They have supplied me with many hours of interesting reading and practical how-to-do-it articles.

It came somewhat as a surprise to note in the March issue the article, "How to Be a Good Father to a Gifted Child." At first

STRAIGHT TALK TO PARENTS

How to Be a Good Father to a Gifted Child

glance this topic seemed to be out of place. After reading it, I found myself enthusiastic about it and about your plan for a series of articles to help parents prepare their children for satisfying careers.

The author, John K. Lagemann, has made sensible use of material from the experts. Congratulations on your plan.

Frank W. Hubbard, National Education Association, Washington, D. C.

. . . I was pleasantly surprised to find the article, "How to Be a Good Father to a Gifted Child." As our natural resources become scarce, we shall have to rely more upon the ingenuity of our people. A tremendous potential will be wasted unless we can somehow encourage youngsters with real ability. That implies, first, the identification of such children while they are still early in their school career. It means giving all of them a chance to develop to their fullest ability. It means, too, having really good teachers challenge such a youngster, and the support of parents in doing so.

For the first time in our history, our school system has a real competitor in Soviet Russia. The school systems of Europe, dedicated as they were to a class education, did not offer serious competition . . . Russia, however, has developed a school system comparable to our own and in some ways better. Russia has spent a much higher percentage of its income on its schools than we have. Articles such as yours will help to awaken the school conscience in our country. We hope before it is too late.

Merle M. Kauffman, Director of Curriculum, Peoria Public Schools

For this month's article in our series, "Straight Talk to Parents," see page 60.

Profit Depends on How You Figure

The chap who wrote "Now You Can Trade In Your House" [Feb.] should get a new broker. Just where is the "neat $2,000 profit" that he says could be earned by living in an $11,000 house for five years and then selling it for $13,000? That $11,000 could have been farmed out at say five percent if not "invested" in a home. The interest alone represents a housing expense of $2,750 over five years. And how about the cut extracted on the "profit" by the Federal tax extortion-

ers? Or local taxes? Or the decline in the value of the dollar through inflation?

Even so, I want my own home. But I'm not wearing blinders as to where the money goes.

John W. Morton, San Rafael, Calif.

Don't Block Car's Rear Window

I'll bet Gus is kicking himself. In "Hints from the Model Garage" [Jan.], he makes two suggestions that contradict each other. First he says take a good look out the rear window before you start to back up. Then he suggests a fence for the rear-seat shelf to keep boxes from slipping forward. This will encourage people to place boxes there

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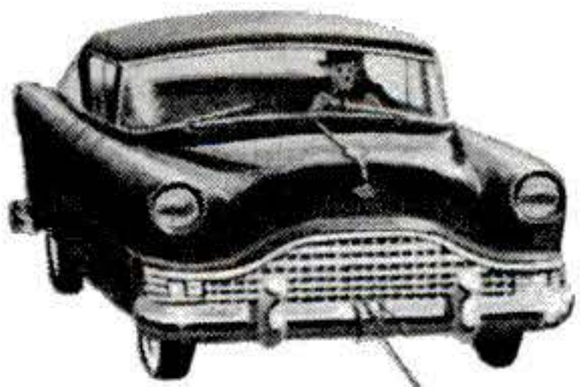
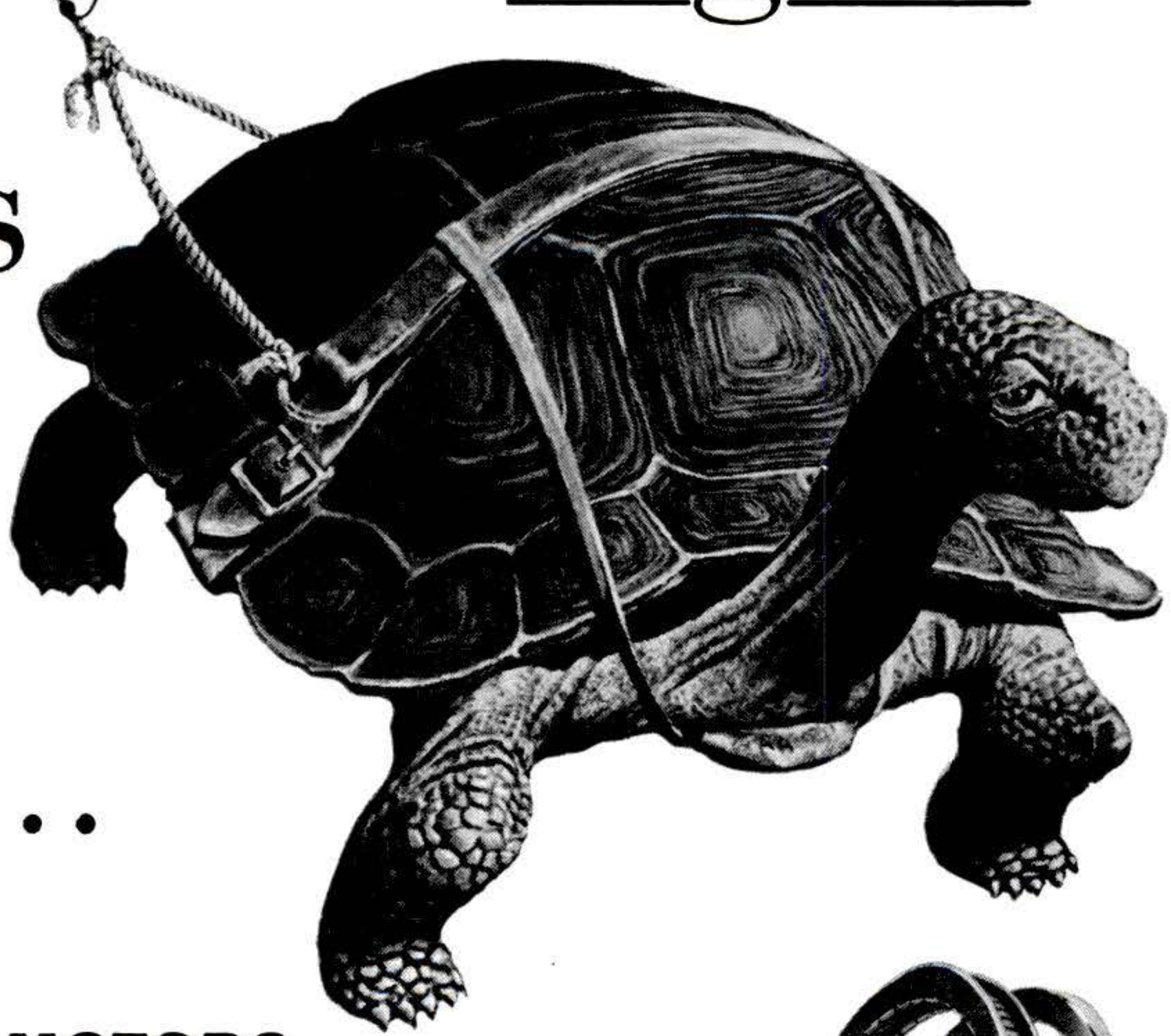


If your engine feels like this...



See your

DOCTOR OF MOTORS

It's no fun to drive a car that's as sluggish as a "tired turtle"—and it's so unnecessary! Your skilled Doctor of Motors knows how to diagnose what ails a tired engine—and equally important—he has a remedy.

Skilled mechanics everywhere also know that there is no better way to restore full responsive power, with positive oil control, than to install Perfect Circle 2-in-1 Chrome piston rings. Perfect Circles are plated with thick, solid chrome that resists wear, *more than doubles the life of cylinders, pistons and rings.* Perfect Circle Corporation, Hagerstown, Indiana; The Perfect Circle Co., Ltd., Don Mills, Ontario.

PERFECT CIRCLE

2-IN-1 CHROME PISTON RINGS

restore that New Car Feel

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Enclosed find 75¢ for Artisan's Tie Clasp.

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and they won't be able to see out the rear window at all.

BYRON W. GRANT, Los Angeles

The fence Gus described was too low to obstruct rear vision. But anyone adopting the idea would have to restrain himself from using the fence to hold big packages, which not only obstruct vision but can cause injury in hard stops or crashes.

Should You Dunk Your Typewriter?

I HEARTILY disagree with the article "He Dunks Typewriters in the Kitchen Sink" [Feb.]. That is undoubtedly the worst piece of misinformation ever printed.

I have been a typewriter repairman for many years and I have worked over many machines that amateurs have tried to re-

pair by such methods. They were a mess.

Let's face it. The typewriter is a precision machine just as much as a clock or watch or automobile and should be handled by people who know what they are doing.

JOSEPH L. ASHLEY, Indianapolis

The PS article was written by an experienced typewriter repairman and checked by experts of one of the largest manufacturers of typewriters. They approved the methods it described.

Visibility: Key to Highway Safety

I ENJOY reading your articles on highway safety. I would like to see someone do some research on the following items.

1. Camouflage. Today, with each car painted two or more colors, they tend to blend into the road and landscape.

2. Tinted windshields. During sunlight hours I have no complaint, but at night how does the tint affect the contrast pattern?

3. Parking lights. Most state laws forbid the use of parking lights for driving, but the law is not enforced. Driving lights cost nothing to burn, let's use them.

A. L. LINDELL, O.D., New Richmond, Wis.

Some research has been done on all these points. The consensus of the experts:

1. Two-tone cars are more visible (a yel-

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This man is a "security risk"!

Age, 29. Married. Two children. High school education. Active in local lodge, church, veterans' organization. Employed by large manufacturing concern. Earns $82 a week.

SOUNDS like an Average Joe. And he is. Too average! He's got a job. It pays fairly well. He's satisfied.

But here's the catch. With the right kind of training, this young man could be stepping into better jobs. He could be making $7-8000 a year. He could be cashing in on those spare-time hours he now wastes.

As it stands now, he's stuck in his job. Can't seem to make any headway. He's reluctant to try. So he just hangs on.

This man is a "Security Risk" to his wife and children.

His family probably will never enjoy the comforts, the prestige, the good living that could be theirs. If hard times come, they are almost sure to be hurt. For an Average Joe can't expect to compete with trained men when the chips are down.

A man like this would do well to start a planned program of self-improvement. In his spare time. In a field related to his interests and abilities. Right NOW!

One good way to start—a way proved by hundreds of thousands of once-Average Joes who are making good today—is to enroll for special training with a recognized correspondence school. One like I. C. S., the oldest and largest in the world.

Don't *you* be a "Security Risk." Mail the coupon for full, free details while there is still time.

For Real Job Security—Get an I. C. S. Diploma! **I. C. S., Scranton 9, Penna.** Member, National Home Study Council

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- ☐ Building Contractor
- ☐ Building Estimator
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- ☐ Carpentry and Mill Work
- ☐ Heating
- ☐ Painting Contractor
- ☐ Plumbing
- ☐ Reading Arch. Blueprints

ART
- ☐ Cartooning
- ☐ Commercial Art
- ☐ Fashion Illustrating
- ☐ Magazine Illustrating
- ☐ Show Card and Sign Lettering
- ☐ Sketching and Painting

AUTOMOTIVE
- ☐ Auto Body Rebuilding
- ☐ Auto Elec. Technician
- ☐ Auto-Engine Tune Up
- ☐ Automobile Mechanic

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- ☐ Retail Business Management
- ☐ Sales Management
- ☐ Stenographic-Secretarial
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CHEMISTRY
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- ☐ Chemical Engineering
- ☐ Chem. Lab. Technician
- ☐ General Chemistry
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- ☐ Petroleum Engineering
- ☐ Plastics
- ☐ Pulp and Paper Making

CIVIL, STRUCTURAL ENGINEERING
- ☐ Civil Engineering
- ☐ Construction Engineering
- ☐ Highway Engineering
- ☐ Reading Struct. Blueprints
- ☐ Sanitary Engineering
- ☐ Structural Engineering
- ☐ Surveying and Mapping

DRAFTING
- ☐ Aircraft Drafting
- ☐ Architectural Drafting
- ☐ Electrical Drafting
- ☐ Mechanical Drafting
- ☐ Mine Surveying and Mapping
- ☐ Plumbing Drawing and Estimating
- ☐ Structural Drafting

ELECTRICAL
- ☐ Electrical Engineering
- ☐ Electrical Maintenance
- ☐ Electrician ☐ Contracting
- ☐ Lineman

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- ☐ Commercial ☐ Good English
- ☐ High School Subjects
- ☐ Mathematics

LEADERSHIP
- ☐ Foremanship
- ☐ Industrial Supervision
- ☐ Leadership and Organization
- ☐ Personnel-Labor Relations

MECHANICAL AND SHOP
- ☐ Gas—Electric Welding
- ☐ Heat Treatment ☐ Metallurgy
- ☐ Industrial Engineering
- ☐ Industrial Instrumentation
- ☐ Industrial Supervision
- ☐ Internal Combustion Engines
- ☐ Machine Design-Drafting
- ☐ Machine Shop Inspection
- ☐ Machine Shop Practice
- ☐ Mechanical Engineering
- ☐ Quality Control
- ☐ Reading Shop Blueprints
- ☐ Refrigeration
- ☐ Sheet Metal Worker
- ☐ Tool Design ☐ Toolmaking

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- ☐ Industrial Electronics
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- ☐ Radio and TV Servicing
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- ☐ Television Technician

RAILROAD
- ☐ Air Brake Equipment
- ☐ Car Inspector
- ☐ Diesel Engineer & Fireman
- ☐ Section Foreman

STEAM AND DIESEL POWER
- ☐ Combustion Engineering
- ☐ Diesel—Elec. ☐ Diesel Eng's
- ☐ Electric Light and Power
- ☐ Stationary Fireman
- ☐ Stationary Steam Engineering

TEXTILE
- ☐ Carding and Spinning
- ☐ Cotton, Rayon, Woolen Mfg.
- ☐ Finishing and Dyeing
- ☐ Loom Fixi'g ☐ Textile Des'ing
- ☐ Textile Eng'r'g ☐ Throwing
- ☐ Warping and Weaving

MISCELLANEOUS
- ☐ Domestic Refrigeration
- ☐ Marine Engineering
- ☐ Ocean Navigation
- ☐ Professional Engineering
- ☐ Short Story Writing
- ☐ Telephony

Name_____ Age_____ Home Address_____

City_____ Zone_____ State_____ Working Hours_____ A.M. to P.M._____

Occupation_____

Canadian residents send coupon to International Correspondence Schools, Canadian, Ltd., Montreal, Canada. . . . Special tuition rates to members of the U. S. Armed Forces.

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low-blue combination has been recommended). Some new trucks of the telephone companies, for instance, are vivid two-tone jobs instead of the old dull green.

2. Uniformly tinted windshields may decrease the driver's ability to see dimly lit areas at night.

3. Parking lights are for parking. In good weather headlights should be as bright as possible without blinding other drivers. In fog or snow, the downward-shining low beams work best.

Who's Paying for the Gasoline?

I HAVE just read the article by my son-in-law, Devon Francis, in the March issue, de-

scribing how he taught my daughter to save gasoline. I would like to remark that I taught my daughter to drive, and that I most certainly did not teach her in the way he describes. She fell into evil hands somewhere along the way! I have watched my son-in-law drive when someone else was paying for the gasoline, and I can testify that he wasn't nearly that careful.

MRS. ESTHER POSTLE, Santa Monica, Calif.

Still Going Strong After 30 Years

THANK you for the photostats of the rigging of the "Sovereign of the Seas" [the article describing the construction of the famous sailing ship was published in PS in 1926]. With these photostats I completed my restoration of the rigging of the model which is now in the new Firelands Museum.

DON J. YOUNG JR., Judge, Probate Court
Huron County, Norwalk, Ohio

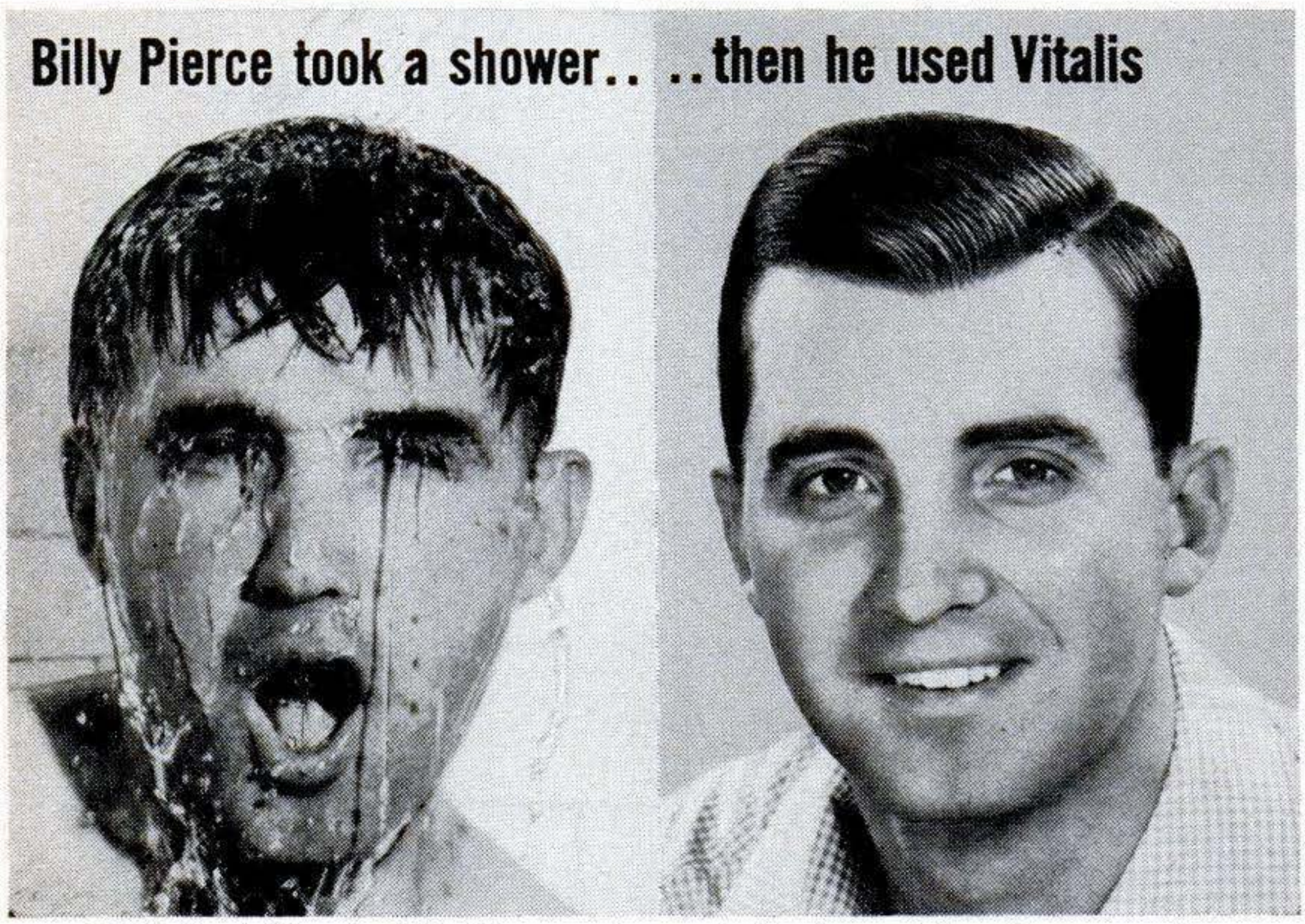
Help for a 1926 Essex

COULD you please tell me where I might secure a service manual for a 1926 Essex? I have bought one and the motor is partly torn down.

RALPH R. PRIEHS, Mason, Mich.

A 1926 service manual is not an easy thing to come by these days, but you may get some help from Automobile Old Timers, Inc., or

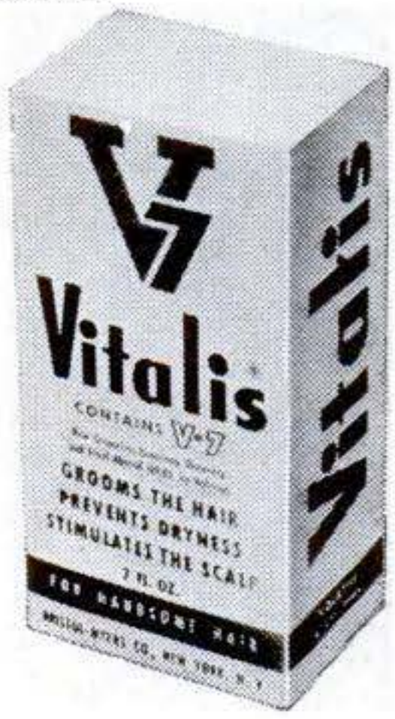
New greaseless way to keep your hair neat all day



White Sox lefthander Billy Pierce rarely goes to the shower before the game ends.

Want the pitch on a greaseless hair tonic?

New Vitalis keeps hair in place and prevents dryness with V-7, the *greaseless* grooming discovery. You never have an over-slick, plastered-down look. Try it. You'll *like* it.



ANOTHER FINE PRODUCT OF BRISTOL-MYERS

New VITALIS® Hair Tonic with V-7®

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If... YOU WANT TO ENJOY AN ACCOUNTANT'S CAREER

INVESTIGATE THIS OPPORTUNITY TODAY!

IF you're that person, here's something that will interest you.

Not a magic formula—not a get-rich-quick scheme—but something more substantial, more practical.

Of course, you need something more than just the desire to be an accountant. You've got to pay the price—be willing to study earnestly, thoroughly.

Still, wouldn't it be worth your while to sacrifice some of your leisure in favor of interesting home study—over a comparatively brief period? Always provided that the rewards were good—a salary of $4,000 to $10,000 and up!

An accountant's duties are interesting, varied and of real worth to his employers. He has *standing!*

Do you feel that such things aren't for you? Well, don't be too sure. Very possibly they *can* be!

Why not, like so many before you, investigate LaSalle's Problem Method of training for an accounting position?

Just suppose you were permitted to work in an accounting firm under the personal supervision of an expert accountant. Suppose, with his aid, you studied accounting principles and solved problems day by day—easy ones at first—then more difficult ones. If you could do this—and could turn to him for advice as the problems became complex—soon you'd master them all.

That's the training you follow in principle under the LaSalle Problem Method. You cover accounting from Bookkeeping and Basic Accounting right through Accounting Systems and Income Tax Procedure. As you go along, you absorb the principles of General Accounting, Auditing and Basic Cost Accounting. Then you may choose Commercial Accounting, Industrial Accounting or Public Accounting and prepare for the CPA examinations.

Your progress is as speedy as you care to make it—depending on your own eagerness to learn and the time you spend in study.

Will recognition come? The only answer, as you know, is that success *does* come to the man who is really *trained*. It's possible your employers will notice your improvement in a very few weeks or months. Indeed, many LaSalle graduates have paid for their training—with increased earnings—before they have completed it! For accountants, who are trained in organization and management, are the executives of the future.

Send today for Free Book "Accountancy, The Profession That Pays"

For your own good get all the facts about this completely new and modern accounting training. Write for free book "Accountancy, The Profession That Pays," which will prove that accounting offers brilliant futures to those who aren't afraid of serious home study, and will show the wide range of opportunities that exist today. No cost or obligation. If you want a position of higher income, greater prestige, MAIL THE COUPON NOW!

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I want to be an accountant. Send me without obligation, Free Book, "Accountancy, The Profession That Pays."

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owners swear by
AJUSTOMATIC
shock absorbers

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● A choice of *three* positive settings—soft, normal or firm—to be made in installation.

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SHOCK ABSORBERS

the publication "Motor," both in New York City.

Why Bleach Stops Tires from Skidding

FOR quite a few years now I have enjoyed your stories about Gus Wilson. The one in February interested me more than usual because I have often used household bleach to help tires gain traction on ice.

I don't think Gus's druggist friend had the right explanation for the way the bleach helps [the druggist said that the bleach dissolved ice the way a salt solution would]. The answer, as I found it, is the action of the bleach on the tire itself. After a tire has had a certain amount of use, the tread surface becomes hard and smooth—it feels semi-glazed. The bleach seems to remove this glaze—your fingers won't slide along the tire surface at all.

I drove a rural school bus for a few years, and I carried along a supply of bleach during winter weather. It got me out of some awkward situations.

CLIFF DAWSON, Strathmore, Alberta

Better Way to Pull Molding Nails

AFTER reading Phil McCafferty's article about driving nails back out of moldings so that they would not damage the face of the material [Feb.], I decided to put in my two bits' worth.

The nail hole cannot be used again, and it is already puttied shut. So why not just pull the nail on through the lumber with pliers? That way you won't harm the face.

ALBERT B. JOHNSON, Marysville, Kan.

Fuses Are Necessary, Too

IN YOUR "I'd Like to See Them Make" series, one March suggestion was a danger-signaling electrical device—"an odor would warn you of overloads."

I believe we already have such a device, and it works better than an odor-warning because it's on the job even when you aren't there to smell it:

It's called a fuse box.

An odor-warning is as dangerous as taking whisky for snakebite—it temporarily eases the pain at the risk of killing you eventually.

EDGAR GRUNWALD, Northport, L. I.

The odor-warner wouldn't replace the fuse box. It would merely anticipate an impending fuse blowout. Wouldn't you rather smell trouble brewing than be in the dark when it arrives?

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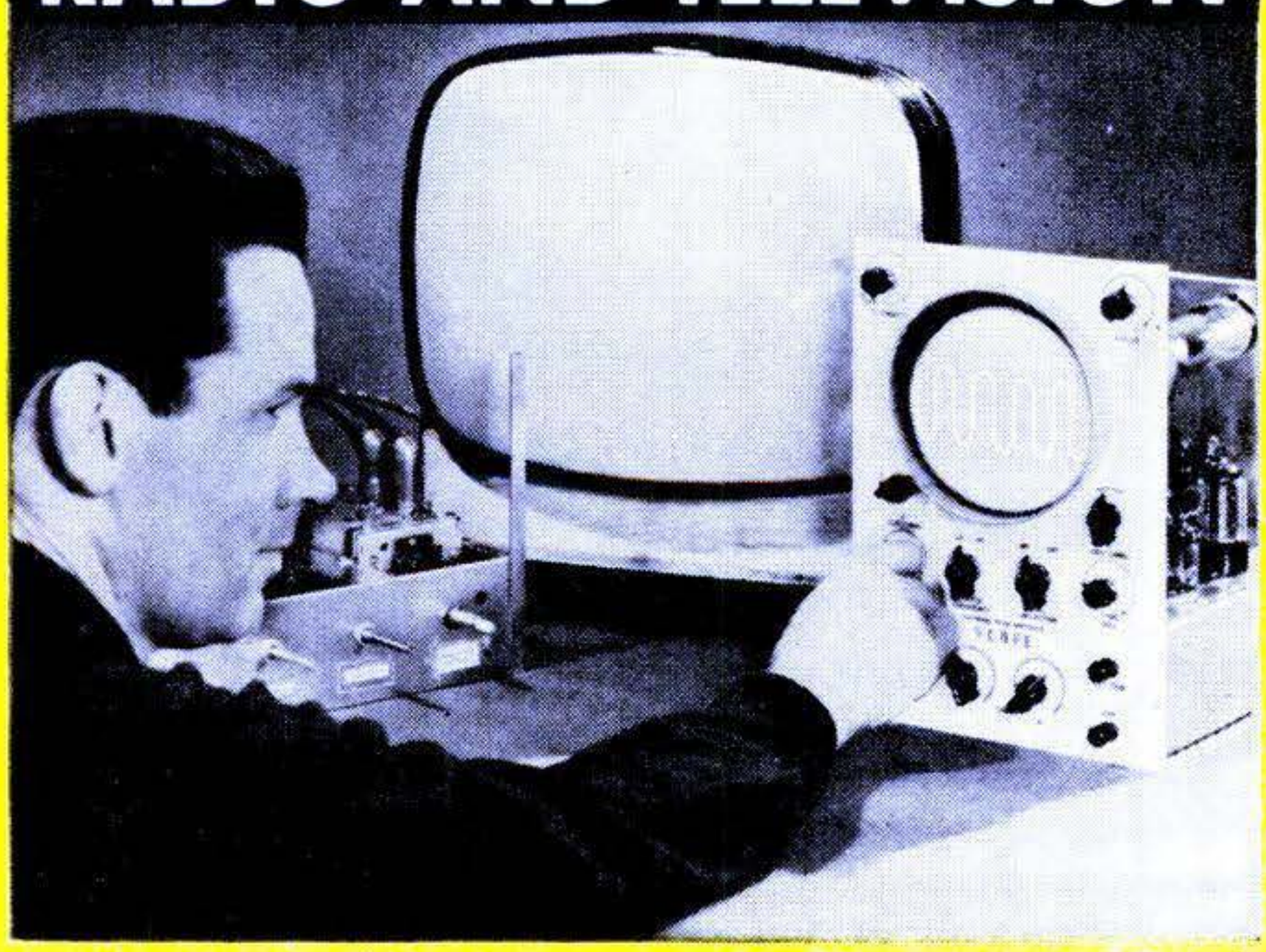
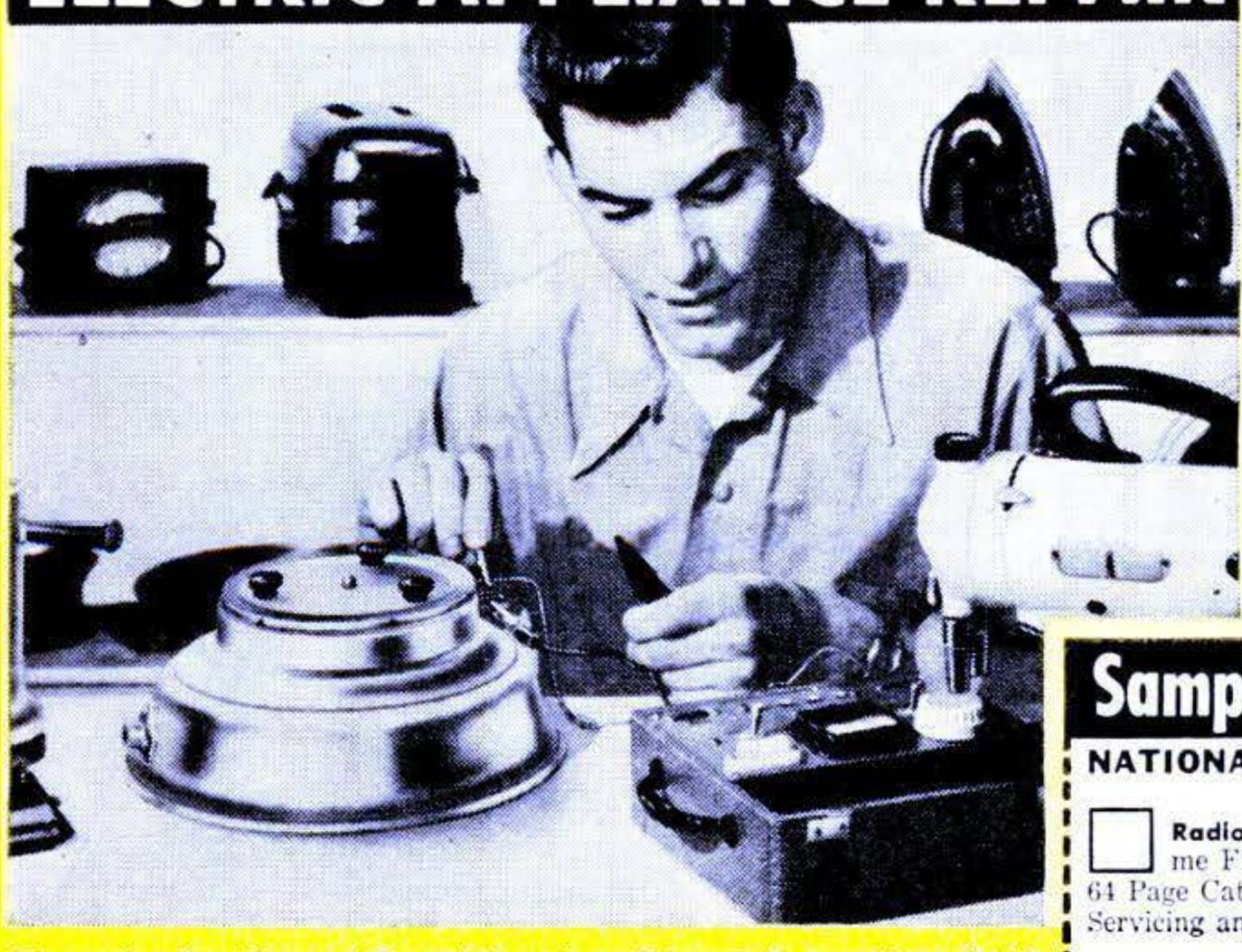
Be a Skilled Technician
Earn High Pay and Prestige

RADIO AND TELEVISION



Television and Radio are big, still growing. That's why TV-Radio Servicing and Communications has special appeal to ambitious men. More than 150 million home and auto Radios, 40 million TV Sets to be serviced. 4,000 Radio and TV stations on the air. Color TV, Hi-Fi, Police, Aviation Radio, Micro-Wave Relay and Two Way Communications are adding opportunities for trained men.

ELECTRIC APPLIANCE REPAIR



Electric Appliance Repairing is a big and growing field. Millions of electric appliances are sold each year. Every wired home now has an average of 8. Owners pay well to keep them serviced properly. The trained man is respected, well paid for what he knows and can do. Mail the coupon now, find out what NRI Electric Appliance Training means to you.

LEARN AT HOME IN SPARE TIME

Do Work Most Men Can't Do!

Training PLUS opportunity is the ideal combination for success. To build a better future, get into a field where there's important work. Have the security that comes from knowing a good trade. The skilled technician enjoys prestige. He does important work, gets high pay for it. No need to give up your present job. NRI will train you at home in spare time. NRI can supply training quickly, provide practical experience by our "learn-by-doing" method.

$10, $15 a Week Extra in Spare Time—Starting Soon

Soon after enrolling, many NRI students start earning extra money in spare time fixing neighbors' radios or electric appliances. Some pay for their training this way, get capital to start their own full or spare time business. No experience necessary. Your NRI Diploma is recognized as the mark of a trained Technician.

Equipment Furnished

Nothing takes the place of practical experience. NRI training is learn-by-doing. As part of NRI's TV-Radio Servicing or Communications courses you get kits of parts to build equipment for practical experience. If you select Electric Appliance Repair Course, tester you build helps you locate defects, make extra money. Decide on the career you want and train for it. Take the first step today. Mail the coupon below for FREE Sample Lesson that shows how you learn, Catalog that tells opportunities, equipment you get. NATIONAL RADIO INSTITUTE, Dept. 7EB, Washington 9, D. C.

Sample Lesson & Catalog FREE

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(CHECK ONE PLEASE—NO SALESMAN WILL CALL)

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☐ **Electric Appliance**—Please send me FREE Sample Lesson and Catalog on your Electric Appliance Servicing Training.

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ACCREDITED MEMBER, NATIONAL HOME STUDY COUNCIL

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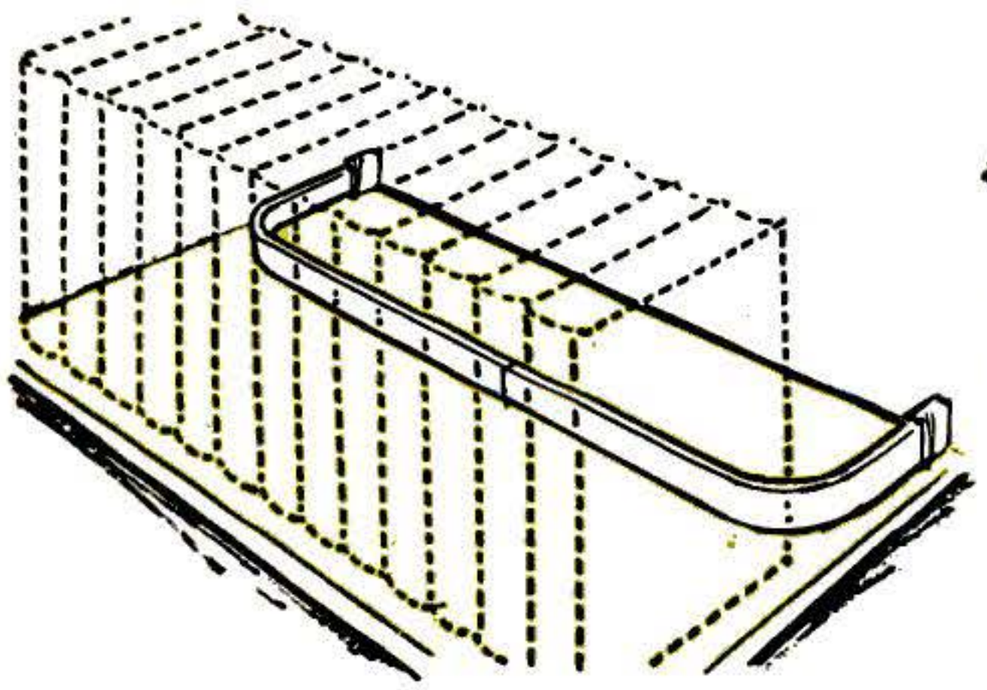
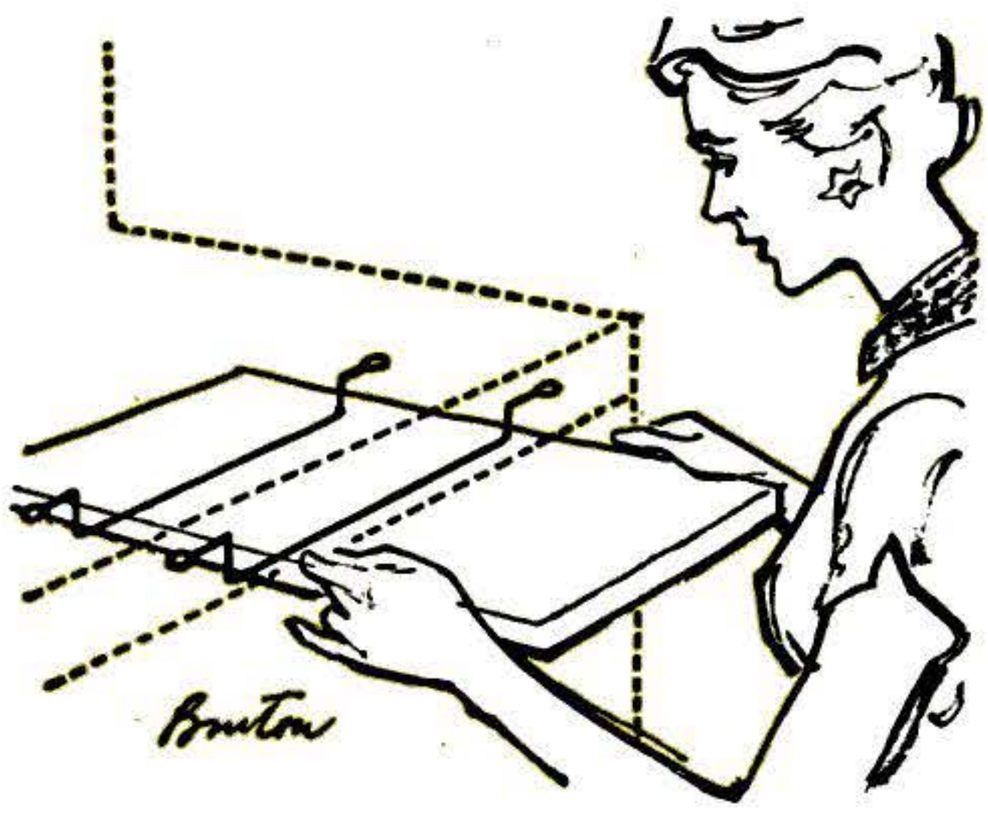
Keeping the Home Shipshape

A SCREEN-DOOR SPRING that snaps firmly against the siding of the house will hold a newspaper or magazine delivered to you. Add a cord pull to yank it open.



SMALL BOOKS ON A DEEP SHELF will stay lined up evenly if a curtain rod is put behind them. Wrap the rod ends with tape to protect the back of the bookcase.

SHEETS OF NEWSPAPER make better drop cloths when painting a room if you keep gaps from opening between them. Shape them over a piece of furniture to give lapped edges, and seal with cellulose tape.



STORE THE CUTTING BOARD under a kitchen-cabinet shelf on rails of coat-hanger wire. Bend the wire to fit the board and form screw eyes at the ends. Put in a stop peg at the rear.

PAIRED SPOOLS mounted on the garage wall make a tool rack that costs nothing. Space the spools to take a tool handle easily and drive nails or screws through the center holes.

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ELECTRONICS TECHNICIAN!

No Previous Technical Experience or Advanced Education Needed!

Laborers and bookkeepers, store clerks, farmers, salesmen — men of nearly every calling — have taken the DeVry program and today have good jobs or service shops of their own in Electronics.

Here's proof positive that it can be done — done by men like yourself — men who had no previous technical experience, no advanced education.

If you are 17 to 55, we will tell you free how you may prepare for exciting, interesting jobs in Automation Electronics, Radar, Guided Missiles, Communications, Industrial Electronics and many others shown at right. Here is a chance of a lifetime to prepare to cash in on one of today's fastest growing fields. Mail the coupon for details.

DeVry Tech's amazingly practical home method enables you to spend minimum time to get maximum knowledge. In fact, you get exactly the same type of basic training equipment used in our Chicago and Toronto training laboratories — among the finest!

Send coupon for free facts NOW!

Live-Wire Employment Service

DeVry Tech's Placement Department is in contact with some of the best-known employers in the Electronics field. The service is free to all graduates—and DeVry Tech's record in helping to place men has been outstanding.

Draft Age?

We have valuable information for every man of draft age; so if you are subject to military service, be sure to check the coupon.

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- COMPUTERS
- AUTOMATION ELECTRONICS

What a DeVry Tech Diploma Meant to These Men!

G. F. Beane, W. Virginia, was a truck driver. He took the DeVry Tech Training Program, and is now a technical electronics sales representative.

Edward Hahn, Illinois. Was a laborer, now an electronics project engineer with Televiso, Inc. DeVry Tech training helped him prepare for his present position.

Nick Barton, Illinois, came directly from high school to DeVry Tech. Now has his own service shop and tells us he is "literally snowed with work."

George D. Crouch, California, was a retail store clerk. He took the DeVry Program, and today is in the servicing field for himself.

Sample Lesson FREE!

See for yourself how DeVry Tech trains you for real opportunities in Electronics. We'll also give you a free copy of an interesting booklet, "Electronics and YOU."

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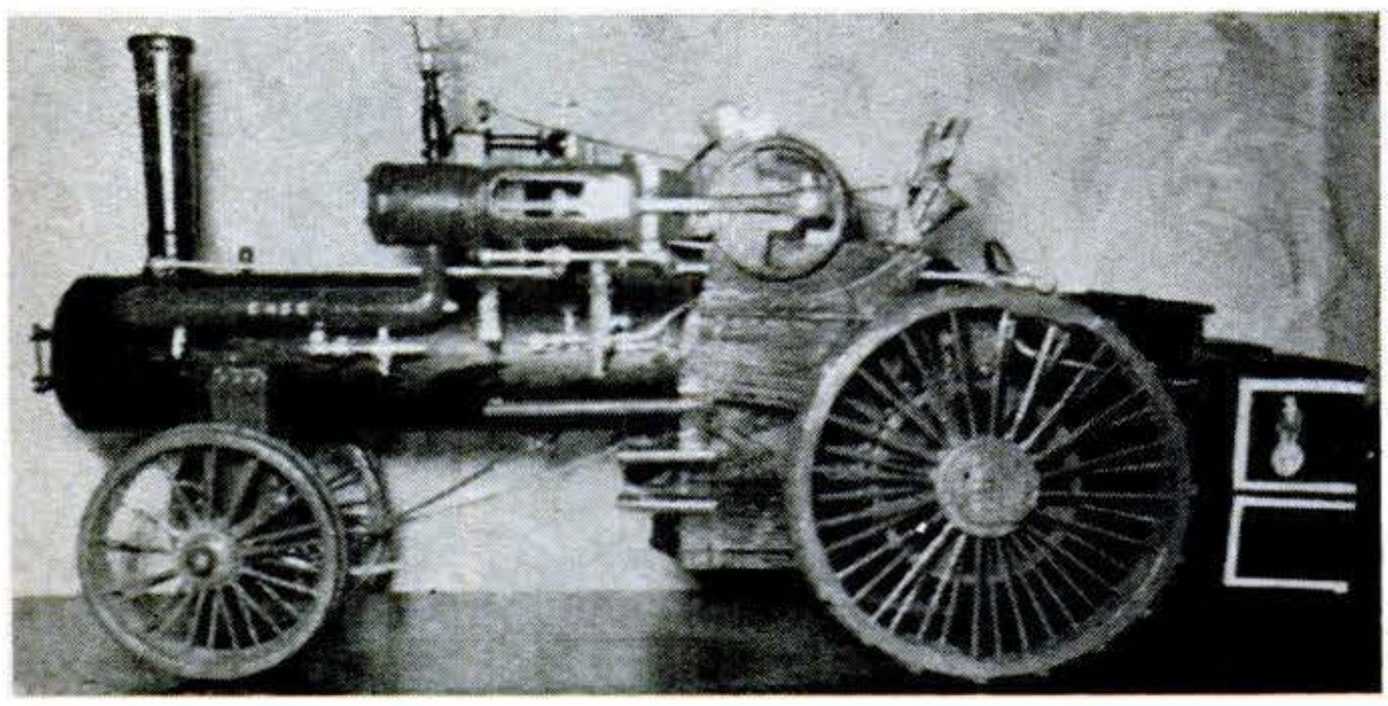
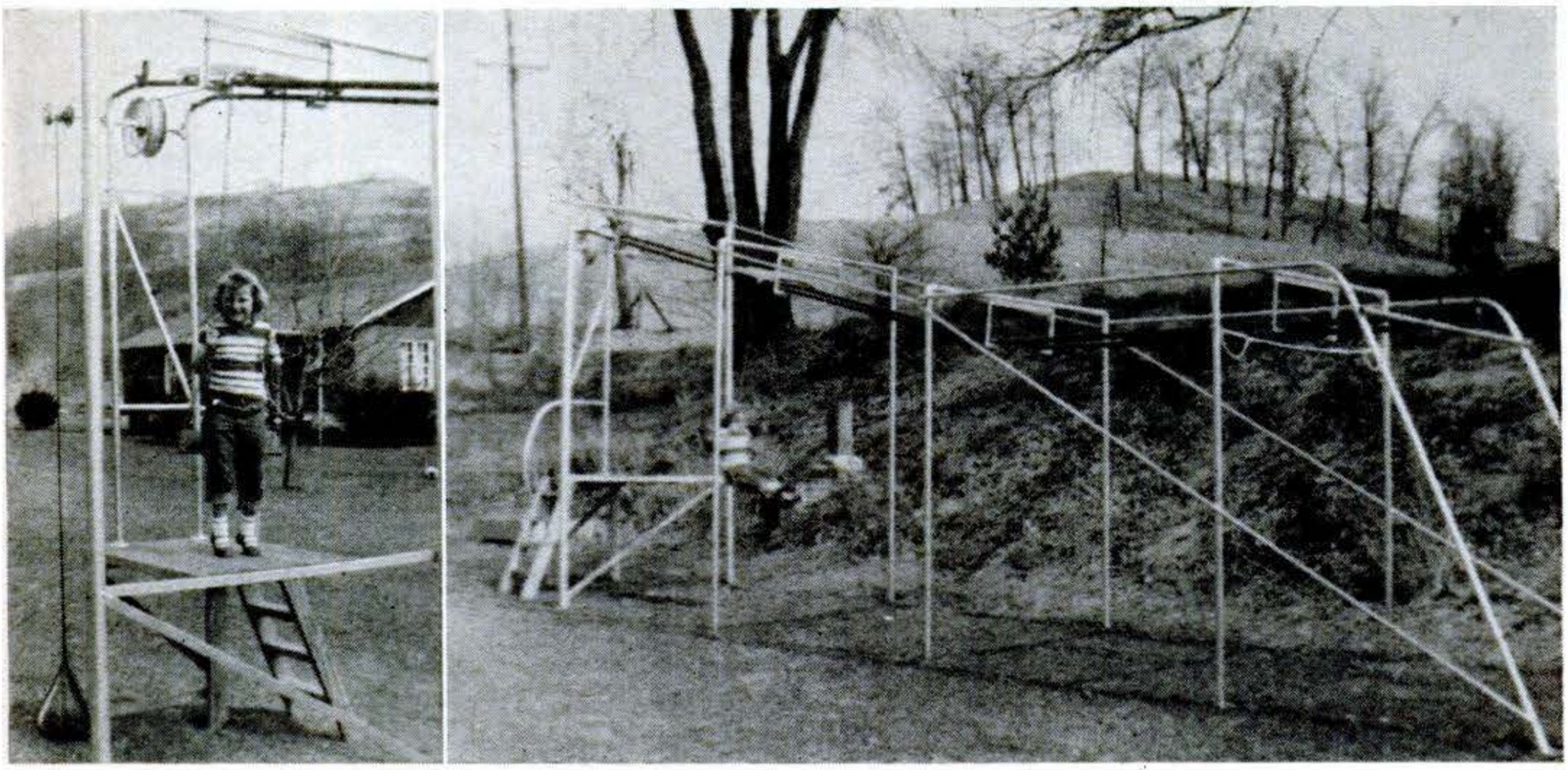
Prize Projects BY PS READERS

Ocean-Going Cruiser. The open sea doesn't faze this 16-foot boat with 5½-foot beam, says Arthur E. Ashton of Ludlow, Mass. He planked it with pine and oak, and powered it with an engine from a '47 Austin. Ashton figures it cost him $233.80, including the converted engine and homemade outrigger.



Antique Tractor. Here's a wooden miniature of a now-ancient steam tractor that was once the latest thing for running threshing rigs. Completing the intricate model was one of the hardest projects in 25 years of woodcarving by Raymond Coe, Kensett, Iowa.



Swing-mobile. Ordinary swings seem tame after kids take off on this coasting thriller built by Emmett L. Baker of Gypsy, W. Va. An overhead carriage and track guide the swing downgrade; springs and chain stop it at end of the line. Reels and sandbag-weighted cord return it empty to the launching site.

Have *you* recently completed a workshop project of which you are particularly proud? Send a good photograph of your work, along with the negative and a brief description, to the Mechanics and Handicraft Editor, POPULAR SCIENCE, 353 Fourth Ave., New York 10, N. Y. We will pay $15 for each item that is accepted for publication.

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Up to 9 Miles More Per Gallon! Up to 20 More Horsepower!

All From One Simple Change in Your Car!

YES! In the next two minutes I'm going to show you how you can get up to 20 MORE HORSEPOWER from your car . . . how you can save enough gas in a single year to drive up to A FULL THOUSAND MILES . . . how you can eliminate most of the ignition knocks and pings that are driving you crazy now . . . how you can get battery-saving, sure-fire starting even in below-freezing weather—and do it without buying one single complicated gadget —without paying a mechanic a penny! How? SIMPLY BY CHANGING THE COLOR OF YOUR SPARK PLUGS!

By ED MITCHELL

Let me say this at the start. What I'm offering you on this page is a very simple investment. I want you to try the most fantastic spark plug in the world, entirely at my risk! A spark plug that costs *only a few pennies* more than the old-fashioned model that's on your car today. A spark plug that lasts up to 10 *times as long* as that old-fashioned model . . . that gives you the *full blazing horsepower* that that old plug is robbing you of today . . . and that actually saves you enough gas *to drive half way across America,* every single year that you use it!

Does this sound impossible? *It's been proven a thousand times this year!* Here is a small sample of that proof.

This Is Why Your Car WastesGas,LosesPower

Some day, if you ever have a spare moment, *lift one of the spark plugs out of your car!* Look at the bottom of that plug. In 10 seconds, you'll learn more about gas waste than any book could teach you in a year.

If that plug has been in your car a thousand miles or more, then what you'll see on the bottom of that plug is *FILTH!* The Firing Point of that plug — the most important single point in your car—*will be choked to death with BLACK, FILTHY CARBON! Carbon that robs your car of as much as 20 vital horsepower every time your engine fires!*

Now, wipe that filth away. And look at the Firing Point itself. This is the *POWER POINT* of your car . . . the pin-head of electricity that turns raw gas into 200 horsepower of driving energy! And what is the condition of that Point? *CORRODED . . . PITTED . . . SCARRED . . . AND WORN!* Hardly able to deliver half the spark it should! Wasting gas . . . wasting money, every time you put your foot down on the pedal!

Yes! You pay $2000 . . . $3000 . . . $4000 for your car. *And a single 98c part robs you* of the real power and enjoyment of that car.

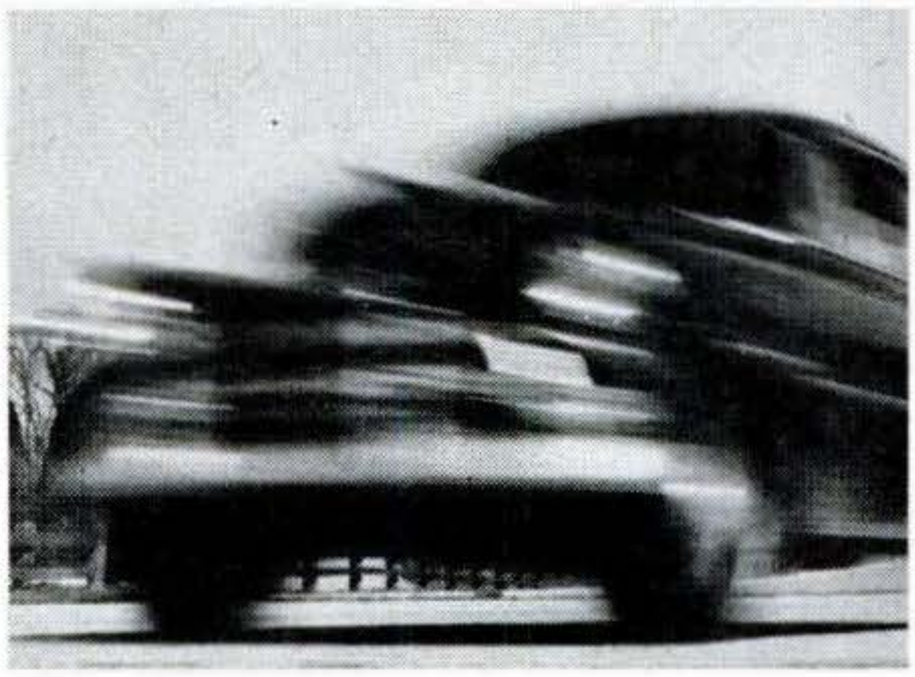
At Last A Plug So Smart That It "Thinks"

Now look at the new plug—the *jet-finish "POWER-FLASH"* plug that I send you—*for only a few pennies* more than you're paying today!

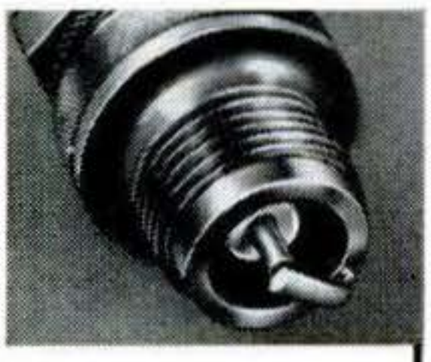
Here is a plug that has not only *ONE* firing point—but hundreds of firing points! That fires so fast, so effectively, so often that it actually *ELIMINATES THAT DEADLY CARBON . . . BURNS IT UP . . . THROWS IT AWAY . . . KEEPS ITSELF SPARKLING CLEAN, ON EVERY SINGLE STROKE!* The full, blazing horsepower that was there when your car was brand-new, is *still* there 30,000 miles later.

But that's just the beginning! *This plug actually gives you the different firing power* you need for every driving condition — smooth, dependable power for city stop-and-go driving . . . effortless horsepower for the parkway . . . blazing reserve power for super speeds! No more missing, sputtering, knocking when you want to pull ahead of other cars at high speeds! No more groaning take-offs at the lights! *FULL POWER 24 HOURS A DAY* . . . or we send you a new set *Free.*

And that's still just the beginning! Best of all — this is the toughest, strongest, longest-lasting plug ever made! *YOU COULD ACTUALLY POUND IT AGAINST A CONCRETE WALL WITH A HAMMER, WITHOUT EVEN DENTING IT — AND THIS AMAZING PLUG WOULD STILL FIRE CLEAN AND HOT FOR 30,000 MILES!* Yes! These fantastic plugs give you such terrific, consistent, long-lasting service that we can afford to make *one of the most amazing guarantees you ever heard!*



See The Amazing Difference Yourself!



This new "Power-Flash" Hi-Compression Power Plug (on the left) is guaranteed to be the most powerful longest lasting Spark Plug ever made! Here's why:

1. Only "Power-Flash" gives you an unlimited number of firing points — plus a guaranteed minimum of 800% more spark action than ordinary plugs! Higher compression, longer engine life, more mileage, power and pep!

2. Only "Power-Flash" gives you automatic heat and gap control! Actually thinks for itself! Gives you faster, wider spark for smoother performance, instant starting, faster pick-up even in freezing weather!

3. Only "Power-Flash" gives you exclusive self-cleaning action! Actually forces plug to clean itself. Plugs run cleaner, cooler, longer! No more fouling "ping" or power loss!

4. Only "Power-Flash" gives you toughest insulators made! Lifetime guaranteed — diamond-like hardness! Gets rid of deadly heat up to 30 times faster than ordinary insulators!

Plus this startling guarantee: Satisfaction guaranteed for two full years or 30,000 miles . or a new set free! Act today!

Try It at My Risk, Today!

What have you got to lose? These amazing jet finish *"POWER-FLASH"* plugs cost only $1.45 each — or $8.70 for a complete set for six-cylinder cars, and $11.60 for a complete set for eight-cylinder cars. *They cost only a few pennies more than ordinary old-fashioned plugs—and they can save you up to $100 this year!*

Here is my guarantee to you. Put these plugs in your car yourself. No mechanic needed. Nothing to adjust. From the very first moment that you get back in that car and drive, you must notice amazing new power and pick-up —or I'll send you a new set free!

You must notice new gas savings . . . you must eliminate most ignition knocks and pings . . . you must get instant carbon-free, cold weather starting . . . and you must get this thrilling, new-car performance year-in and year-out — *FOR TWO FULL YEARS, OR 30,000 MILES* — or I'll send you a new set — *FREE!*

You have nothing to lose! *BUT THE SUPPLY OF THESE PLUGS IS STRICTLY LIMITED. THE NICKEL ALLOY WHICH MAKES UP THEIR ELECTRODES IS HELD IN SHORT SUPPLY BY THE UNITED STATES GOVERNMENT. THIS WILL BE ABSOLUTELY THE LAST TIME WE CAN MAKE THIS OFFER! ACT TODAY!*

FREE BONUS!

Sensational, Nationally Advertised, Car Book Saves You Up To $250 On Repairs This Year Alone!

Over a quarter-of-a-million drivers have paid up to $3.00 for the same exact money-saving handbook! But now IT'S YOURS FREE!

The legendary Car Book that made history by showing millions of economy-minded car-owners how they could save up to $250 a year in costly gas and repair bills. The sensational book that ripped the lid off all the professional tips and tricks known by the nation's trouble-shooters and ace mechanics! Here, are all the eye-opening, money-saving secrets that save you dollar after dollar in costly car upkeep and repairs.

Here are simple tips that show you how to add amazing mileage to your car — without touching a tool — without even lifting the hood of your car! Here's a fantastic 30-second trick that gives you up to 2-3-4 miles more per gallon! Another secret shows you how to switch one single wire and save up to 50 gallons of gas in your winter driving . . how you can add up to 10,000 more miles to your tires . . how to get your "dead" battery started in just one minute — without a push or a tow!

Yes, professional tips that can save you hundreds of dollars a year! And it's all yours — *FREE!* How would you like to get power to zoom away from other cars at the lights . . . to drive up to 5,000 miles— without changing your oil! Other ingenious tips show you how to remove rust from your chrome . . . make dents and scratches disappear for good . . to stop steering wheel "play" . . . how to adjust your own brakes and save $5 . . to repair your clutch yourself and save $13 . . to fix a leaky radiator and save $20!

Yes, all this and more is yours—absolutely *FREE* — our *BONUS GIFT* to you with your purchase of the amazing new *"POWER-FLASH" PLUGS* which are absolutely guaranteed for two years or 30,000 miles of the most fabulous spark plug service you've ever enjoyed! But if you want this special *FREE BONUS* — the sensational book "How To Double The Performance Of Your Car" — you must order your *"POWER-FLASH" PLUGS* today! Our supply of this free, Final Edition of the Car-Book is limited! So act *NOW!*

HERE'S PROOF!

Users Report Fantastic New Mileage — Breathtaking New Power!

"Your Power Plugs are well on the way to paying for themselves. So far have saved about $8.00 a month on my gasoline bill. As far as I can figure, I am getting 9 miles more per gallon of gas than I used to get.

"Although I did have a new set of spark plugs in my car before replacing them with your Power Plugs, the old plugs made my engine spit and gallop. Now it really runs smooth and starts a lot better, too." *R. O., Duluth, Minn.*

"I bought your plugs for my '54 Ford some time ago . . . as far as I can tell I am getting at least 8 miles per gallon better mileage. Also my Ford has far better pickup and horsepower. I have driven about 12,000 miles since purchasing the plugs and they are in as good condition as ever." *C. M., Avilla, Indiana*

"I replaced the equipment-type spark plugs in my Lincoln Continental with yours. With the old style plugs, I was getting approximately 15 miles to the gallon. During the first thousand miles of operation with Power Plugs, my mileage increased to 22 miles per gallon. This was an increase of 7 miles per gallon. In addition to the increased mileage, I was happy to notice much better idling and absolutely no stalling. Hills which I formerly took in second gear now present no problem in climbing with high gear. My heavy Continental used to lope away from signals; now it dashes away."

D. C. W., President Exporting Co.

A BOSS MECHANIC SAYS:

"I earn my living repairing automobiles. As a master mechanic I have installed all kinds of spark plugs over the past 18 years. You boys really have something. I have never seen a plug before that fires so true and hot and on our test equipment, every installation has shown a big increase in horsepower; as much as 20% in some cases. For the boys who want more power and better pickup, you have the answer."

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"Your plugs have been in my car now for three or four months, and I must say it's running better than it ever did before, and I am getting a lot better mileage out of it. At least as much as the 15% you claim.

"I'd say your plugs are well worth the price you ask, especially as I do not expect to have to buy a new set as long as I have my present car—a 1953 Mercury." *R. H. D., Chicago, Ill.*

33,000 MILES WITHOUT A SINGLE ADJUSTMENT

"I have just disposed of the car in which your spark plugs were installed. The following facts may be of interest to you.

"Speedometer reading, mileage at installation—27,756—mileage at this date — 61,334. No replacement nor adjustments since installation and plugs giving perfect service."

G. K. H., Indianapolis, Indiana

AMAZING MONEY-BACK GUARANTEE!

Clip this guarantee section out of this page. It authorizes you to try these amazing POWER-FLASH Spark Plugs *entirely at our risk!* First — test them for one full month for *surging power, thrilling new driving performance, breathtaking gas savings alone!* During that very first month alone:

1) These plugs must give you up to 9 miles MORE per gallon — INSTANTLY — *or every cent of your money back!*

2) These plugs must give you up to 20 MORE horsepower — INSTANTLY — *or every cent of your money back!*

And 3) — as an *extra added* assurance — These plugs must *continue* to give you this power, performance and gas savings — FOR TWO FULL YEARS—*or we will send you a brand-new set, ABSOLUTELY FREE!*

You have nothing to lose! This is probably the most amazing guarantee in car history! No strings! No questions asked! Act TODAY!

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NEW YORK 11, N. Y.

IMPORTANT! Please fill in the entire coupon. PLEASE PRINT!

Gentlemen: Yes, I want to try your amazing "POWER-FLASH" jet-finish Spark Plugs entirely at your risk! I will pay postman only amount checked below plus low C.O.D. charges:

☐ $8.70 for a matched set of six "POWER-FLASH" Spark Plugs.

☐ $11.60 for a matched set of eight "POWER-FLASH" Spark Plugs.

I understand that, these "POWER-FLASH" Plugs must give me more power, tremendous new performance, amazing gas savings . . . must actually do everything you say for a period of 2 FULL YEARS or 30,000 MILES, or I may simply return them for a NEW SET FREE!

Also send me as your Extra Gift Premium, the Free nationally advertised car-book, "How To Double The Performance Of Your Car." This book is mine to keep as a Free Gift even if I return the plugs.

MAKE OF CAR _____ YEAR _____

MODEL _____ NO. OF CYLINDERS _____

NAME _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

☐ CHECK HERE AND SAVE MORE! Enclose check or money order and we pay all postage and handling charges. You save as much as $1.06!

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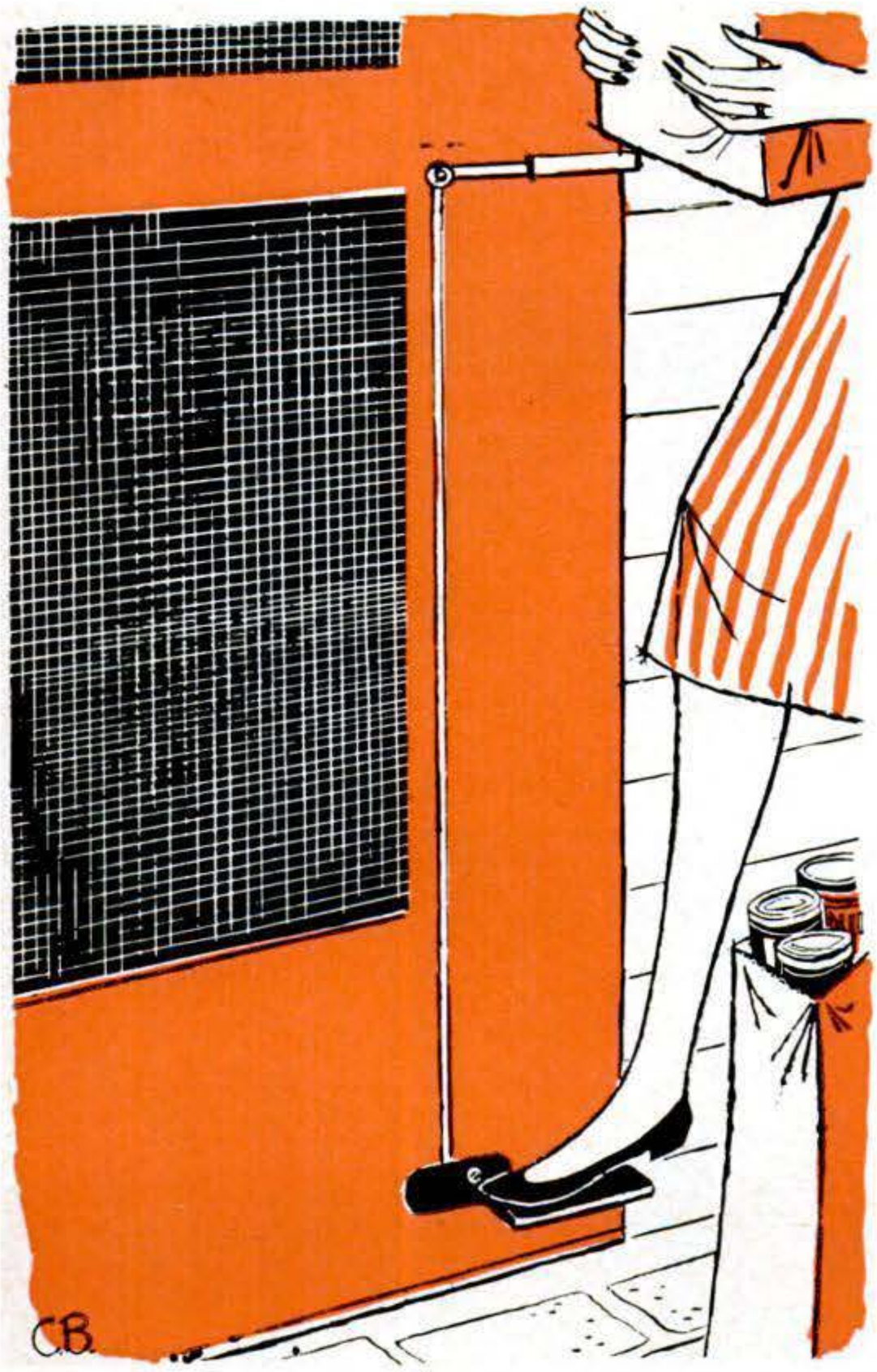
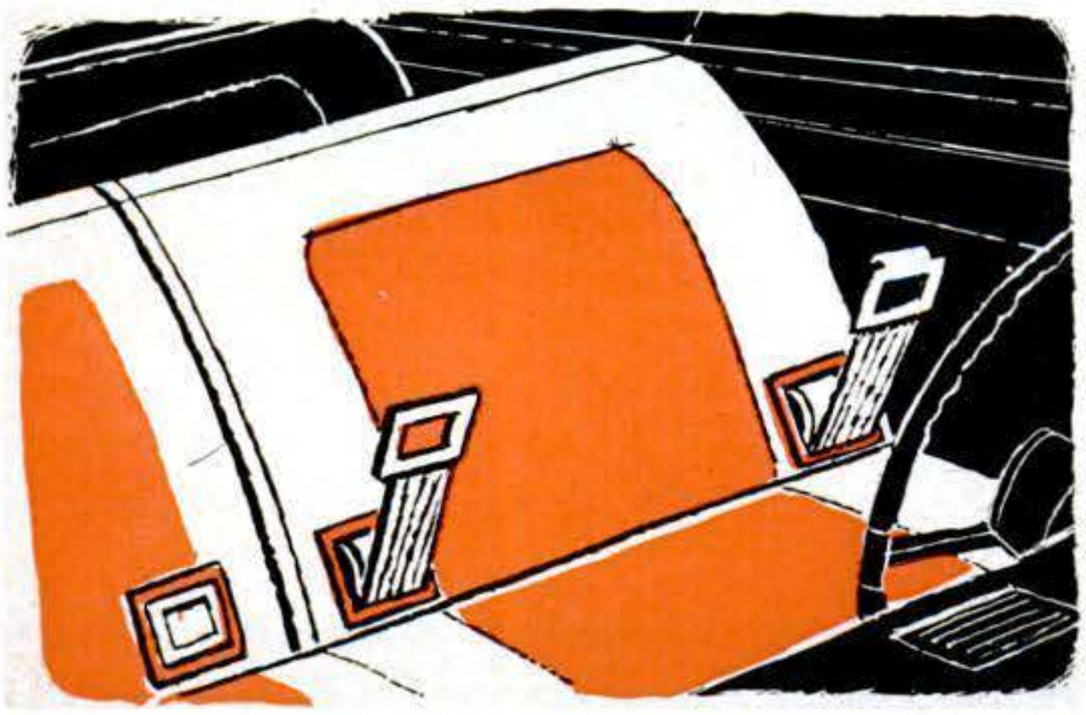
"I'd like to see them make..."



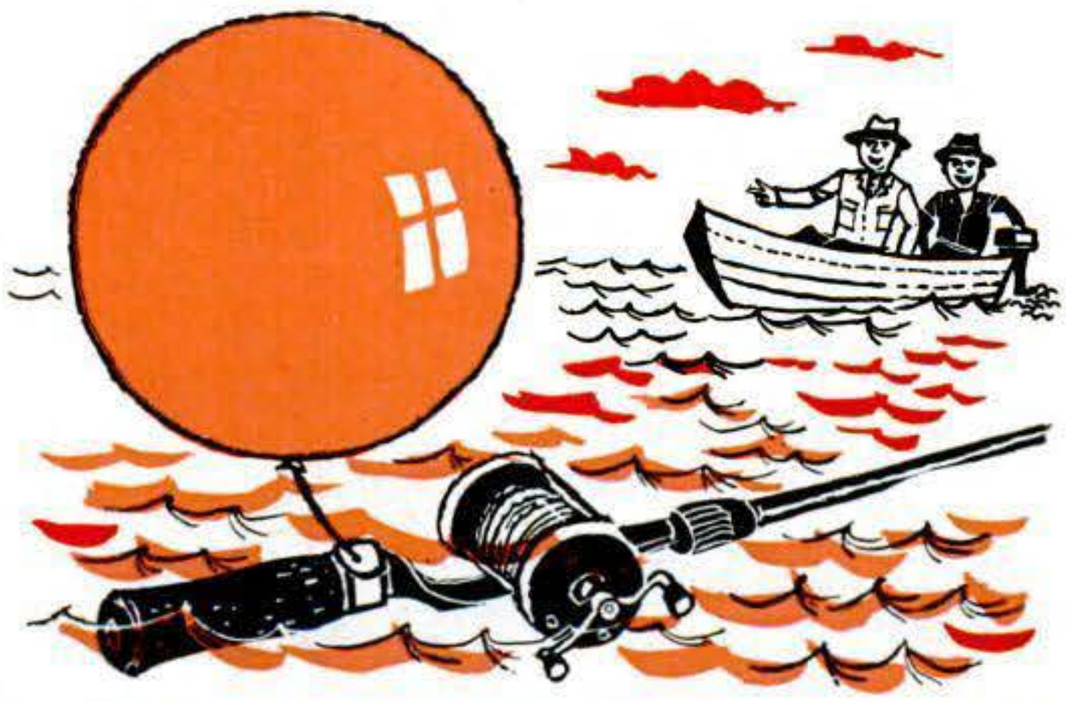
FOOT-OPERATED SCREEN DOORS. Burden-laden shoppers could just step on a lever near the bottom, and a rod running up to the hand latch would lift it.—*Edwin Stastny Jr., Malin, Ore.*

A GIANT SPRING CLOTHESPIN designed to fit over the hook of a clothes hanger to keep it on the line when clothes are put outside for airing.—*Mrs. Clyde E. Bell, Hatfield, Pa.*

A TYPIST'S ERASER GUIDE with built-in dirt catcher. A curving gutter on the bottom of the ordinary plastic shield would catch eraser shavings.—*Roger M. Snook, San Francisco.*



CAR SEAT BELTS ON REELS so that, when unbuckled, the ends wouldn't get in the way on the seat or slide out the side to be caught in the door.—*Henry Baskerville, Richmond, Va.*



RETRIEVABLE FISHING RODS. When a rod fell into water, a capsule in the handle would dissolve, releasing gas into a small balloon attached with string.—*C. H. McDermott, Eagle Grove, Iowa.*

Everyone has his own pet idea of a gadget that he would like to see in general use. The five ideas illustrated above were suggested by POPULAR SCIENCE readers. What's *yours?* We will pay $5 for each one published. Please use Government postcards only. Write name and address clearly. Contributions cannot be acknowledged or returned.

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Thousands sold at $3.95—now 99¢ during our 25th Anniversary celebration. Hi-fidelity views up to 25 MILES AWAY! Clear, sharp images. No distortion. Synchronized center focusing. Sturdy—yet lightweight. No arm fatigue. Imported direct from West Germany. Limit: one to customer. **NO. 78**.....**99¢**

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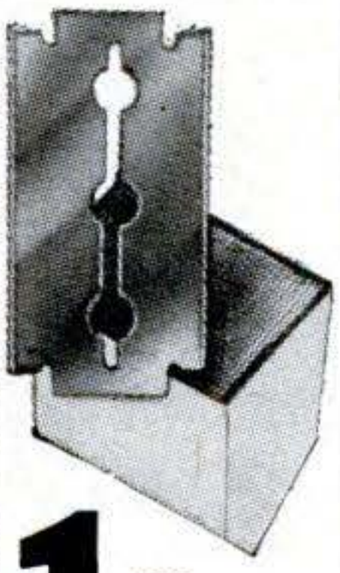

New, first-quality double-edged blades. Fit any razor perfectly. GUARANTEED to give same close shaves as famous-name blades costing 5 times the price! Why help pay for TV commercials when "everything's the same but the name . . . and the price." Others get 20 blades for 98¢. You get 100 for 99¢. Send for trial order now!
No. 131.....**99¢**

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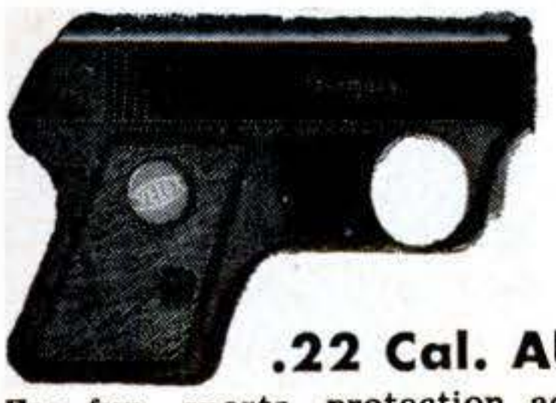

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Without Pen or Paper!

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NO. 139.....**99¢**

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LAST CHANCE

to get Swiss Army type knife at

½ Price!

50,000 SOLD AT $3.95

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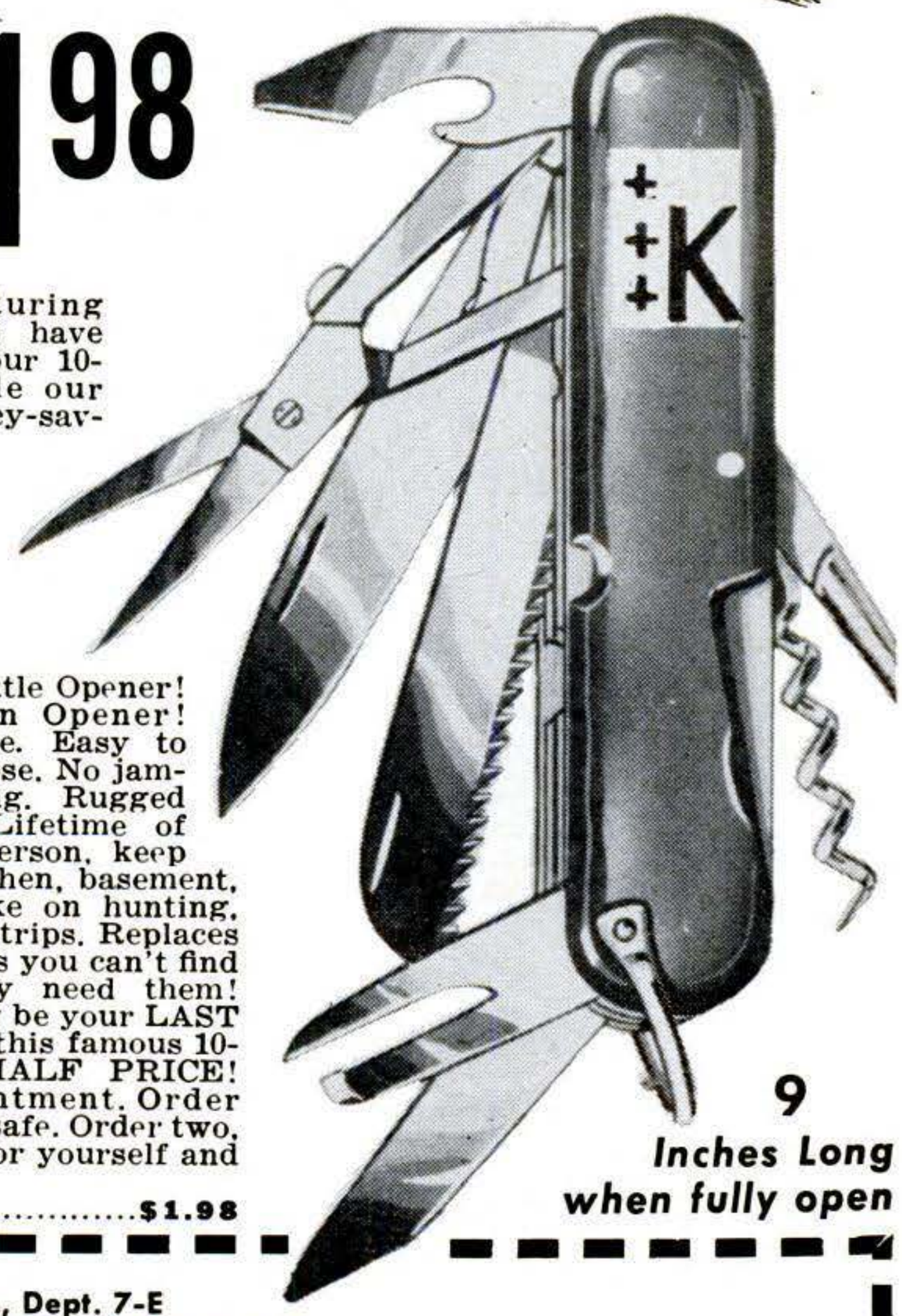
STEEL PRICES ARE RISING!

Steel prices are up! Manufacturing and labor costs are up! This may be your LAST CHANCE to get this famous 10-in-1 knife at HALF PRICE! Stock up now. Order two or more . . . for the home, car, tool shop.



Steel, manufacturing and labor costs have gone up! Get your 10-in-1 knife while our sensational money-saving HALF-PRICE is still in effect! 10 practical, quality tools in one! Saw! File! Scissors! Jackknife! Awl! Small Knife! Screwdriver! Bottle Opener! Corkscrew! Can Opener! Each is separate. Easy to open, use and close. No jamming or slipping. Rugged Korium steel. Lifetime of use. Carry on person, keep in tool shop, kitchen, basement, garage, car. Take on hunting, fishing, camping trips. Replaces multitude of tools you can't find when you really need them! Hurry! This may be your LAST CHANCE to get this famous 10-in-1 knife at HALF PRICE! Avoid disappointment. Order yours now. Play safe. Order two, three or more—for yourself and friends!
NO. 18.....**$1.98**

9 Inches Long when fully open

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RUSH items checked on 10-day home trial. My money refunded promptly—no questions asked—if I am not satisfied.

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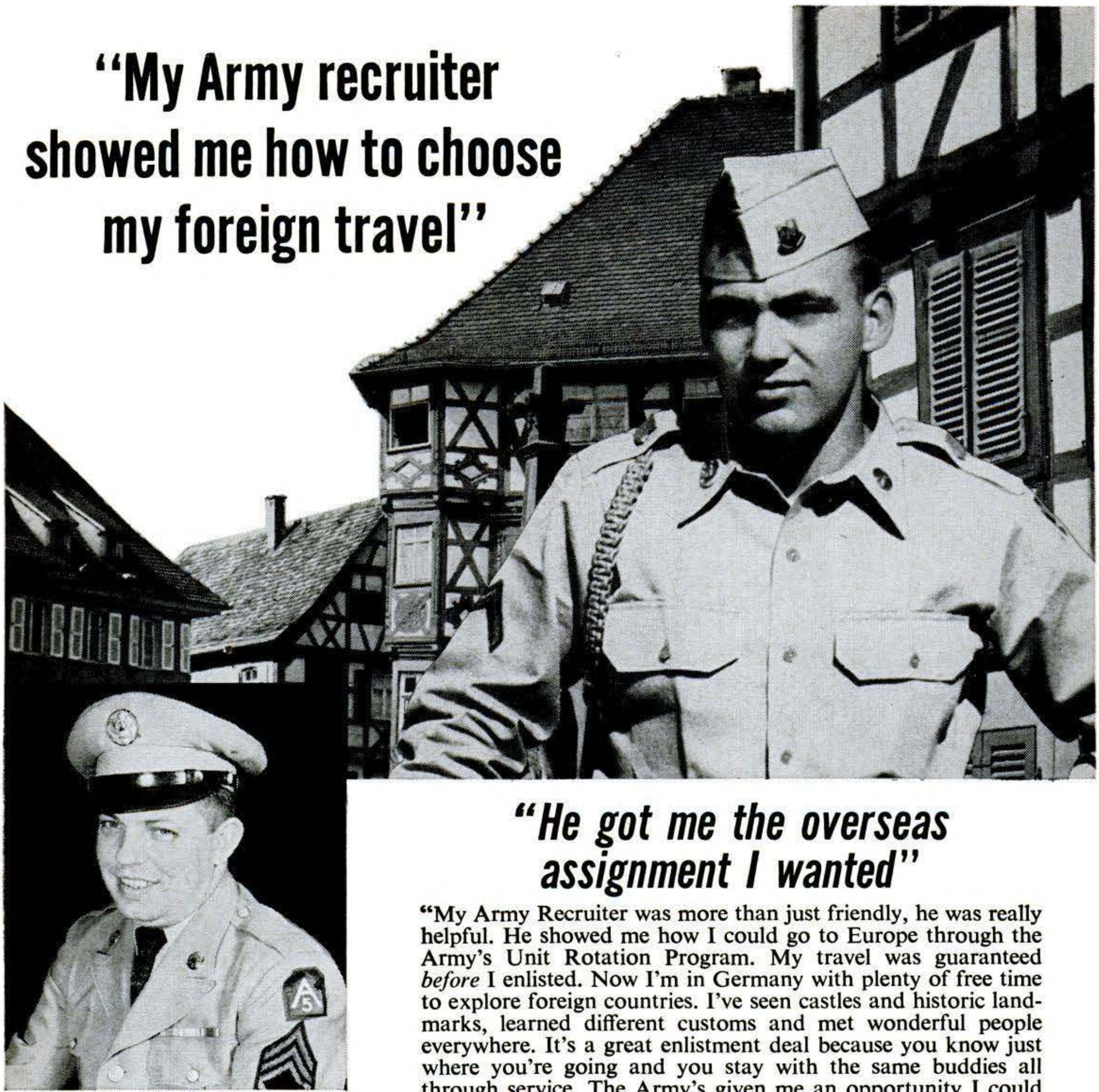
"My Army recruiter showed me how to choose my foreign travel"



Sgt. 1st Class James E. Pfrommer
Army Recruiter, Lafayette, Ind.

"He got me the overseas assignment I wanted"

"My Army Recruiter was more than just friendly, he was really helpful. He showed me how I could go to Europe through the Army's Unit Rotation Program. My travel was guaranteed *before* I enlisted. Now I'm in Germany with plenty of free time to explore foreign countries. I've seen castles and historic landmarks, learned different customs and met wonderful people everywhere. It's a great enlistment deal because you know just where you're going and you stay with the same buddies all through service. The Army's given me an opportunity I could never have afforded otherwise. If you want to travel, why not see your local Army Recruiter and find out what opportunities are open for you?"

Howard E. Lasley

Howard E. Lasley
Graduate, Romney High School
Romney, Indiana

YOUR ARMY RECRUITER WILL HELP YOU GET A SPECIAL TRAVEL DEAL

The Army Recruiter in your town can help *you* get the kind of deal Howard got. There are always new travel opportunities opening up that let you *choose* your own foreign travel *before* you enlist! Europe, the Far East, the Pacific, the Caribbean or Alaska —any one of these exciting areas may be available to you! The wonders of the World may well be as near to you as your local Army Recruiting Station. When you enlist under the Army's special travel options, you know *exactly* where you're going! Your foreign service is *guaranteed!* You see the world at government expense. For your passport to adventure, see your Army Recruiter. There's no obligation!

GET CHOICE, NOT CHANCE, FROM YOUR ARMY RECRUITER

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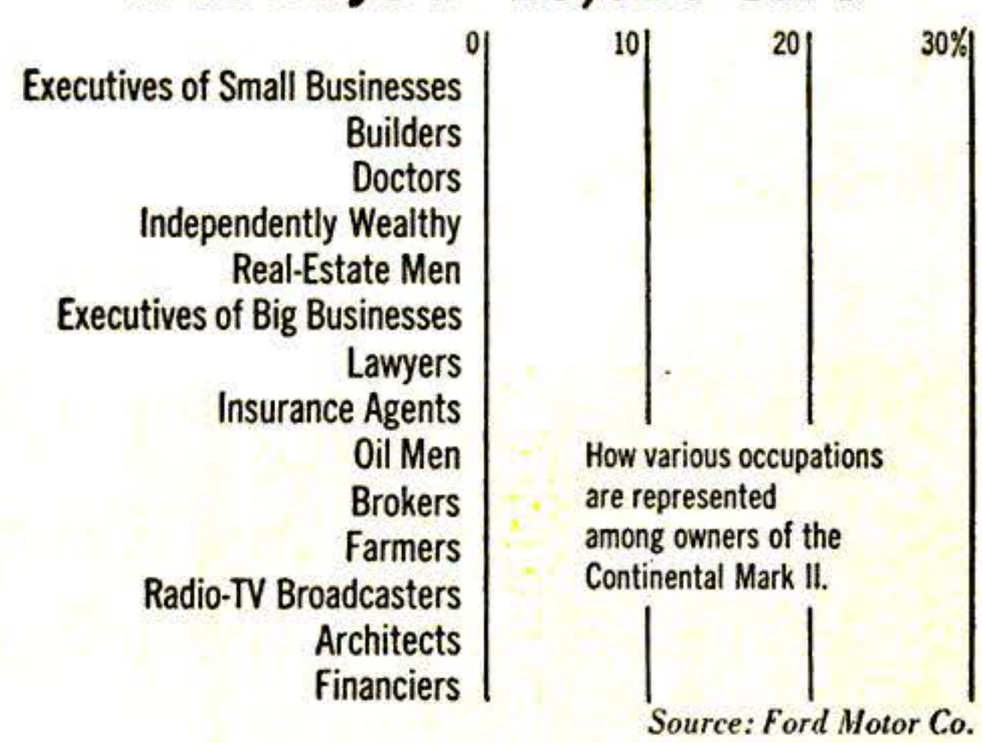
You ought to know...

People are buying new cars again. Last year they didn't, in distressingly large numbers. The picture for 1957 is rosier. Both Ford and Plymouth manufactured considerably more cars during the first two months of this year than they did during the same period in 1956, and Chrysler Corp. chief Tex Colbert said his company's principal problem was filling orders. Another reason for Colbert's optimism: His flashy Plymouth was clearly winning third place in sales away from Buick. Chevy production was down compared to last year, but an increase in the manufacturing rate was scheduled.



Meanwhile, Detroit's research engineers reported progress toward radically new cars of the future. Both Ford and Chevy have turbine-powered trucks rolling around their test tracks. Chrysler doubled the lab space alloted to gas-turbine research, and says it has licked the problem of designing a turbine that can stand up under the high operating temperatures without using any scarce, strategic cobalt or even very much nickel. Hudson and Nash may soon have air-suspension systems—like buses—instead of metal springs, says American Motors engineer Harry Elkins. Another insider predicts that air suspensions will be common on passenger cars by 1960.

Wondering where to go for your vacation this year? Don't overlook the 28,000,000-odd acres of recreation land, ideal for inexpensive family vacations, that federal and state governments have set aside for your use. There's something for every taste: historical sites galore, awe-inspiring scenery, trout streams, beaches, comfortable hotels, or campsites. And no matter where you live you aren't more than a day's drive from at least one.

How can you find out about them? Best source is the National Park Service's big map (35¢), "Recreational Areas of the United States," which tells what there is to do and see at nearly every federal- and state-owned vacation spot. Two other maps (15¢ each), one for the East and one for the West, give more details on the National Parks. There's also a handsome booklet called "National-Forest Vacations" (30¢) that tells all about accommodations and recreational facilities at the National Forests. You

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You ought to know...

can buy the maps and booklets from the Superintendent of Documents, Washington 25, D. C.

New test-tube suits are in the offing. There's been a major break-through in the chemistry of synthetic fibers. It means different, better, possibly cheaper clothing for you and your family. But it also means a tremendous jump in the variety of synthetics. You can already buy men's suits and work clothes made with one or more of six synthetics, each different chemically.

What's happened is this. Ways have been found to move around the atoms that make up the long-chain molecules forming the synthetics. The chemists can juggle the atoms until they get a fiber that looks and acts the way they want it to. This has already led, experimentally, to one new synthetic, isotactic polypropylene, which promises to be stronger than nylon, as well as cheap (the raw material is petroleum). But even more important, the same methods can be applied to the old established synthetics, to make new crossbreeds and variations from them.

The story about the deer fly that streaks 820 m.p.h. belongs in the book of scientific tall tales, along with the one about the bumblebee not being able to fly at all. Top speed for insects is 35 m.p.h. in a short sprint, 27 m.p.h. in steady flight. That's what Dr. Brian Hocking, professor of entomology at the University of Alberta, found after measuring the power output, efficiency, and fuel (nectar, that is) capacity of a number of insects. Common insects don't even come close to the theoretical top. Dr. Hocking did learn that a monarch butterfly can carry fuel for a really long hop—about 620 miles.

How Fast Can a Fly Fly?

Horsefly	14.7 m.p.h.
Lacewing Fly	14.3 m.p.h.
Black Fly	6.6 m.p.h.
Fruit Fly	4.1 m.p.h.
Aedes Mosquito	5.6 m.p.h.
Bee	9.4 m.p.h.

Data adapted from *Transactions of Royal Entomological Society of London* (104:301)

We should purposely leak some military secrets, for our own defense. That's the opinion of Dr. Louis N. Ridenour, the radar expert who directs missile research for Lockheed. He gives two reasons why such seeming foolhardiness is really shrewd strategy:

1. Our military power is supposed to deter an enemy from starting a war. If the enemy doesn't know how powerful we are, he can't be deterred. So, concludes Dr. Ridenour, "A genuinely secret weapon is absolutely worthless in peacetime."

2. In the present game of power politics, we stand a better chance of winning by adopting "a mixed strategy—now bluffing, now telling the truth." This, Dr. Ridenour points out, can be proved mathematically by von Neumann's Theory of Games.

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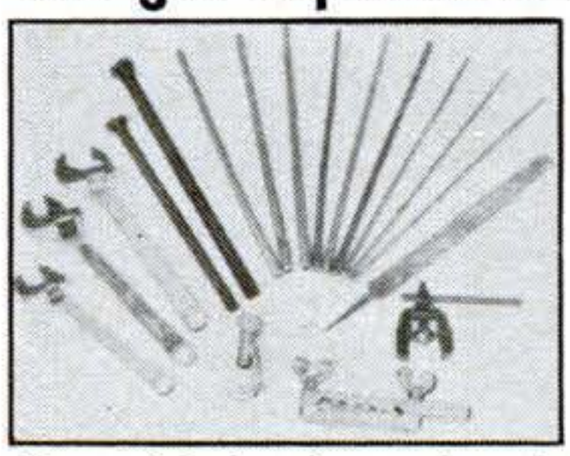
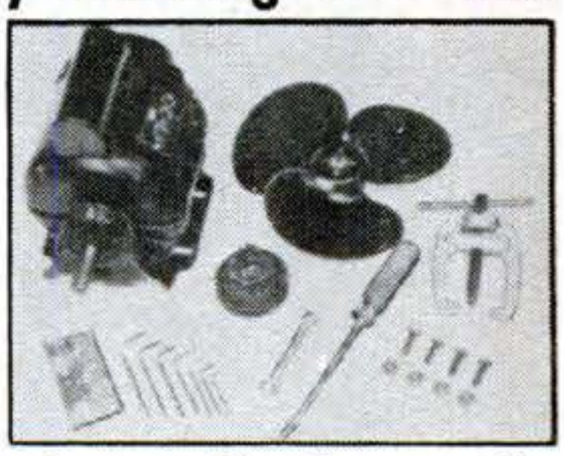
CTI offers a quick, easy way to learn

You learn *fast*—you learn *right*—because you get all parts and tools to build a complete, heavy-duty, commercial-type, ¼ h.p. condensing unit (shown at left). *You do 10 service and trouble-shooting jobs.* You keep this equipment.

You get experience by training with kits





Above left is photo of tools in just *one* kit. You get other tools, tubing, much equipment. In another kit (right), you get motor, fan, pulley, service tools. Kits are sent on planned schedule so that you learn in easy stages. Kits develop skill, speed training. *No extra cost for kits!*

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CTI training is so practical that many students do repairing in spare time. They work with local dealers or "on their own." They earn extra cash, get added experience. Some land full-time jobs while students, others open shops.

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The story on job and business opportunities in the vast Air Conditioning and Refrigeration industry is fascinating. It's told in an interesting booklet which you can have free. We'll send it, along with training information, if you mail coupon. *Act today!*

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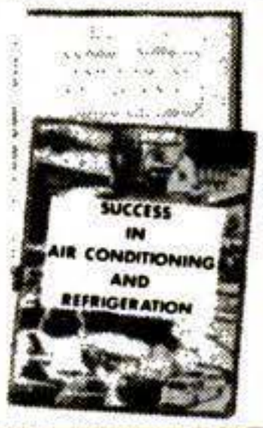

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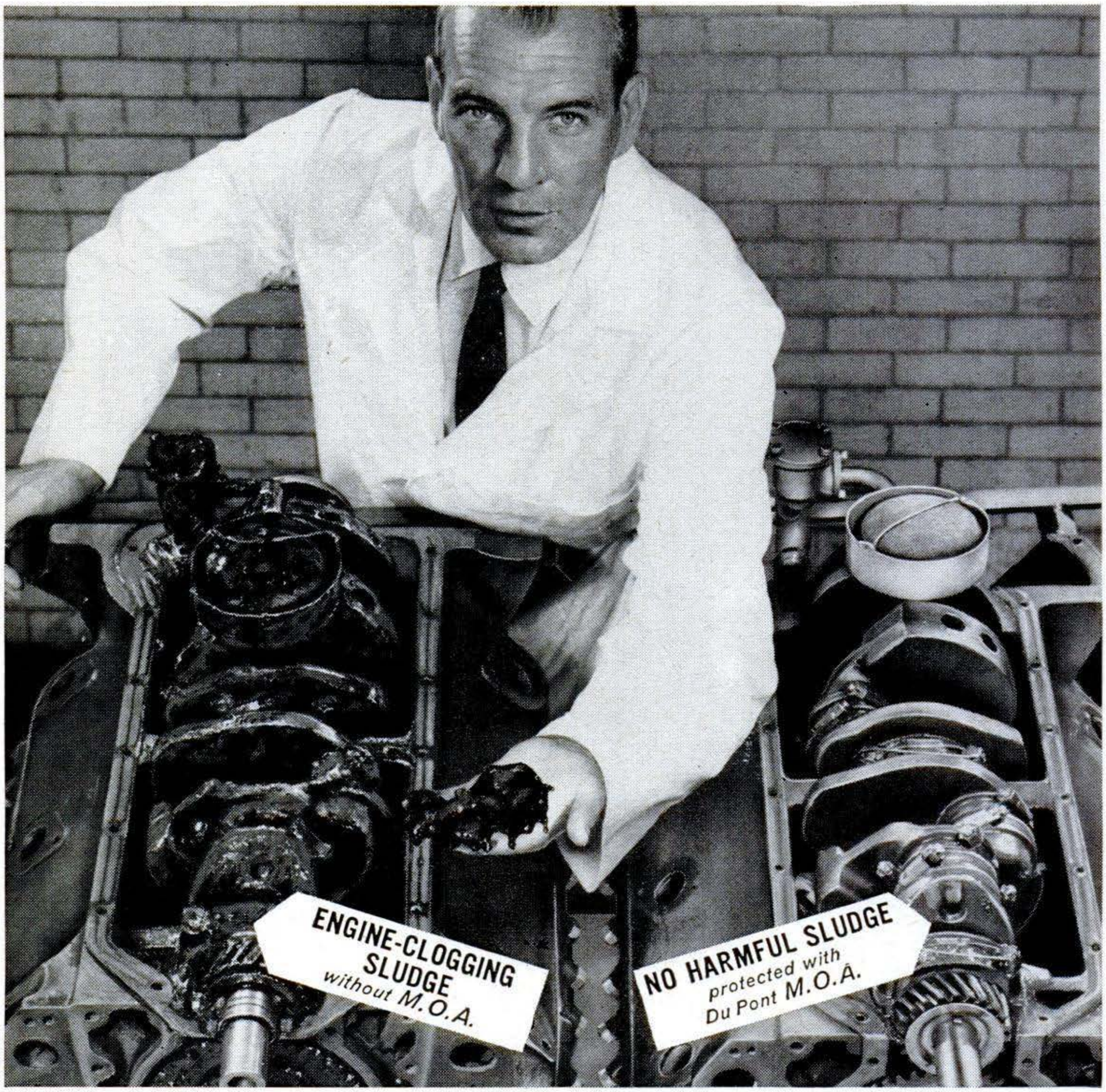
NEW DU PONT DISCOVERY KEEPS



Here's what 4,000,000 miles of road testing proves M.O.A. can do

- Prevents clogging of oil screens and filters—reduces wear
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- Cuts costly engine repair

New patented chemical discovery

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Du Pont M.O.A. keeps vital engine parts free of harmful sludge . . . prevents noisy valves, sticky rings. Saves gas, oil and costly repairs

Imagine keeping your engine operating efficiently for the life of your car! A radically different motor-oil conditioner discovered by Du Pont helps make this possible.

Developed through 12 years' research and over 4 million miles of testing, new Du Pont M.O.A. is effective under *all* driving conditions. Road tests have shown it extends the life of vital engine parts and saves costly repairs.

Engines rated in lab

Without M.O.A.

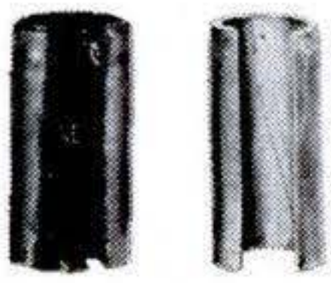
With M.O.A.

In one 48,000-mile test of automobiles operated under severe sludging conditions, engines run without M.O.A. were brought into the laboratory, taken down, and compared with engines operated with M.O.A.

M.O.A.-protected engines were still almost as clean as new, and their oil screens were much cleaner than those in many other engines.

In test engines that didn't use M.O.A., oil lines to rocker arms were repeatedly clogged by sludge. These lines had to be cleaned twice during the test to correct oil starvation. But oil lines in all engines with M.O.A. stayed clean.

Up to 90% less wear



On engines operated *without* M.O.A., camshaft exhaust lobe wear was found to be up to 10 times greater. Camshaft intake lobe wear ranged up to seven times greater. And rocker arm shaft wear ranged from approximately equal to scoring so badly, due to sludge plugging, that no accurate measure could be made.

You'll notice the difference

Quieter valves, smoother-running engine, gas and oil savings are to be expected with M.O.A. And you may notice that your oil turns dark. This is because M.O.A. keeps microscopic "sludge formers" in circulation instead of letting them grow and stick to engine parts. With M.O.A., dark oil means your engine is being kept clean and bright.

Add a can of new Du Pont M.O.A. to your crankcase at each oil change and feel the difference every mile you drive. Available at your service station, car dealer's or wherever auto supplies are sold.

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BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

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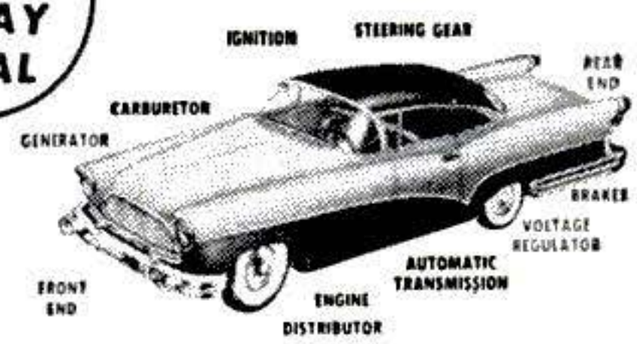

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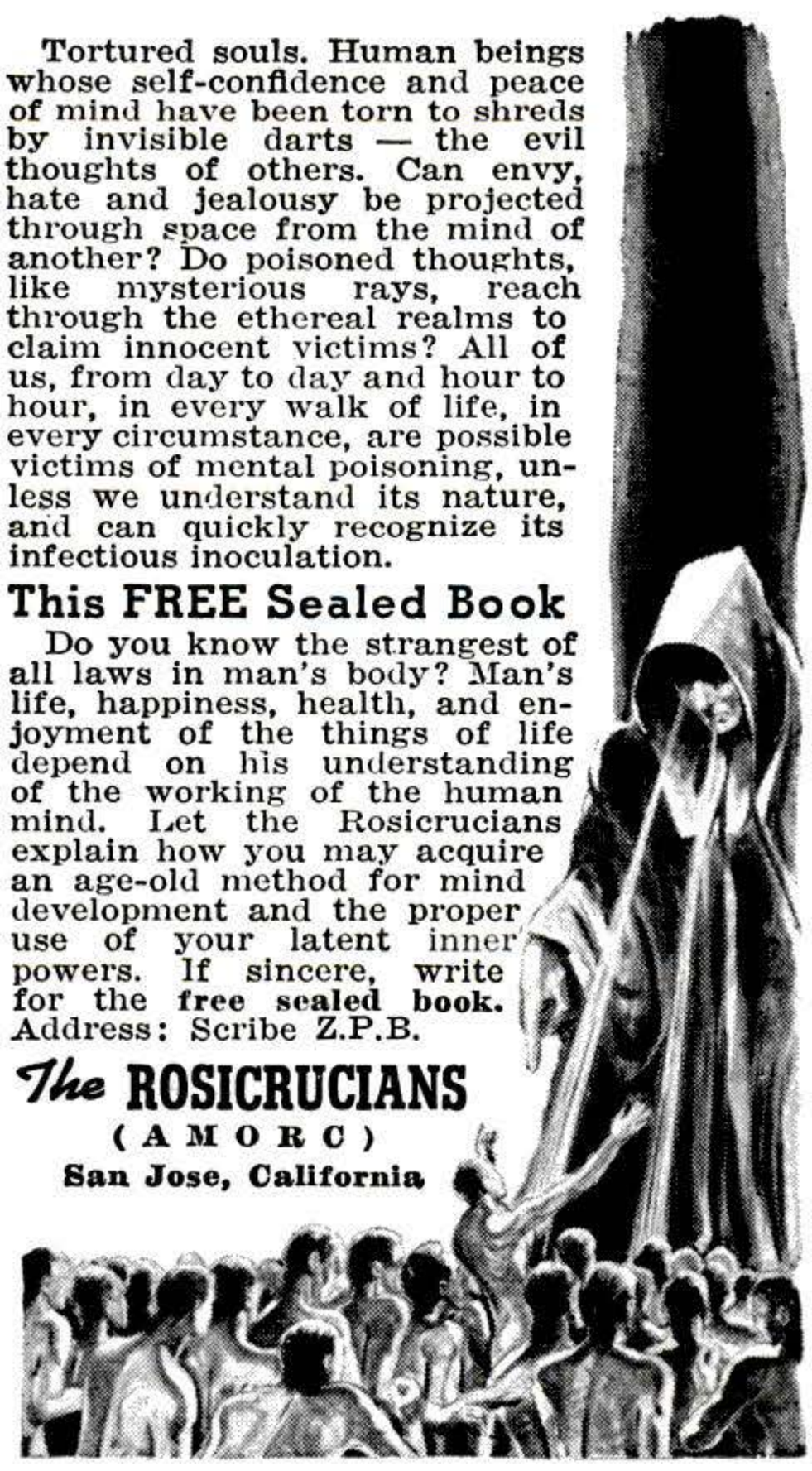

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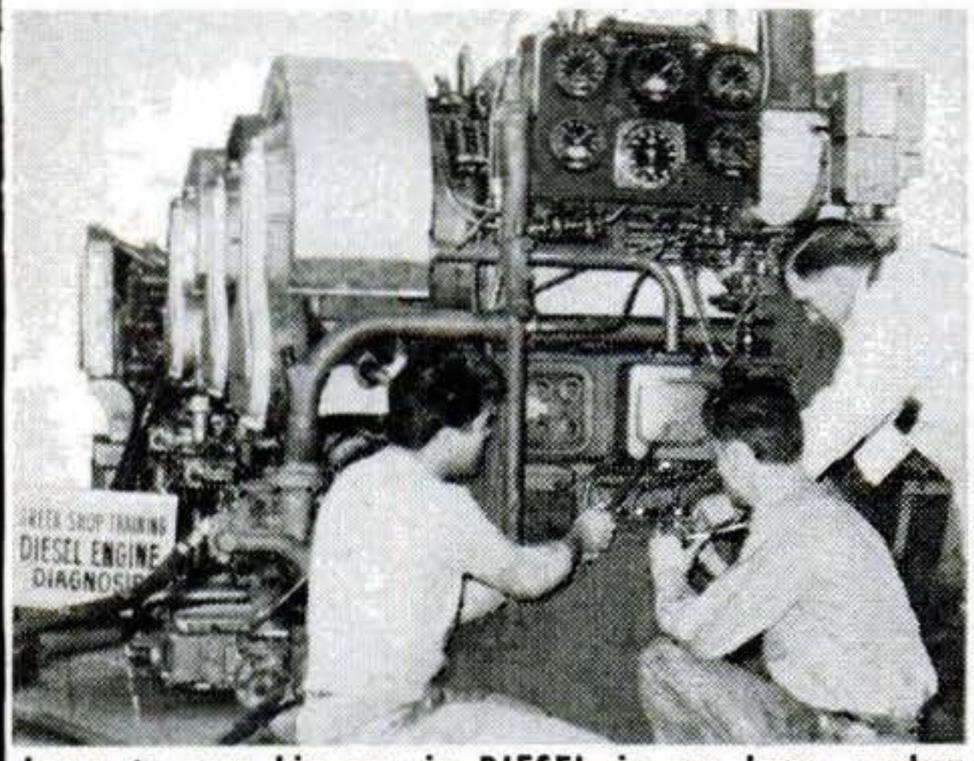

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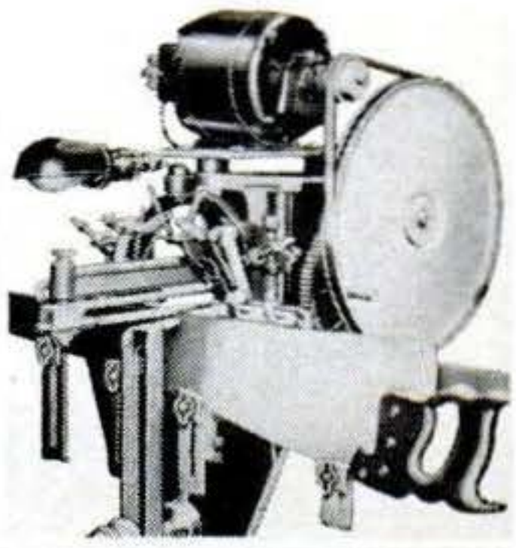

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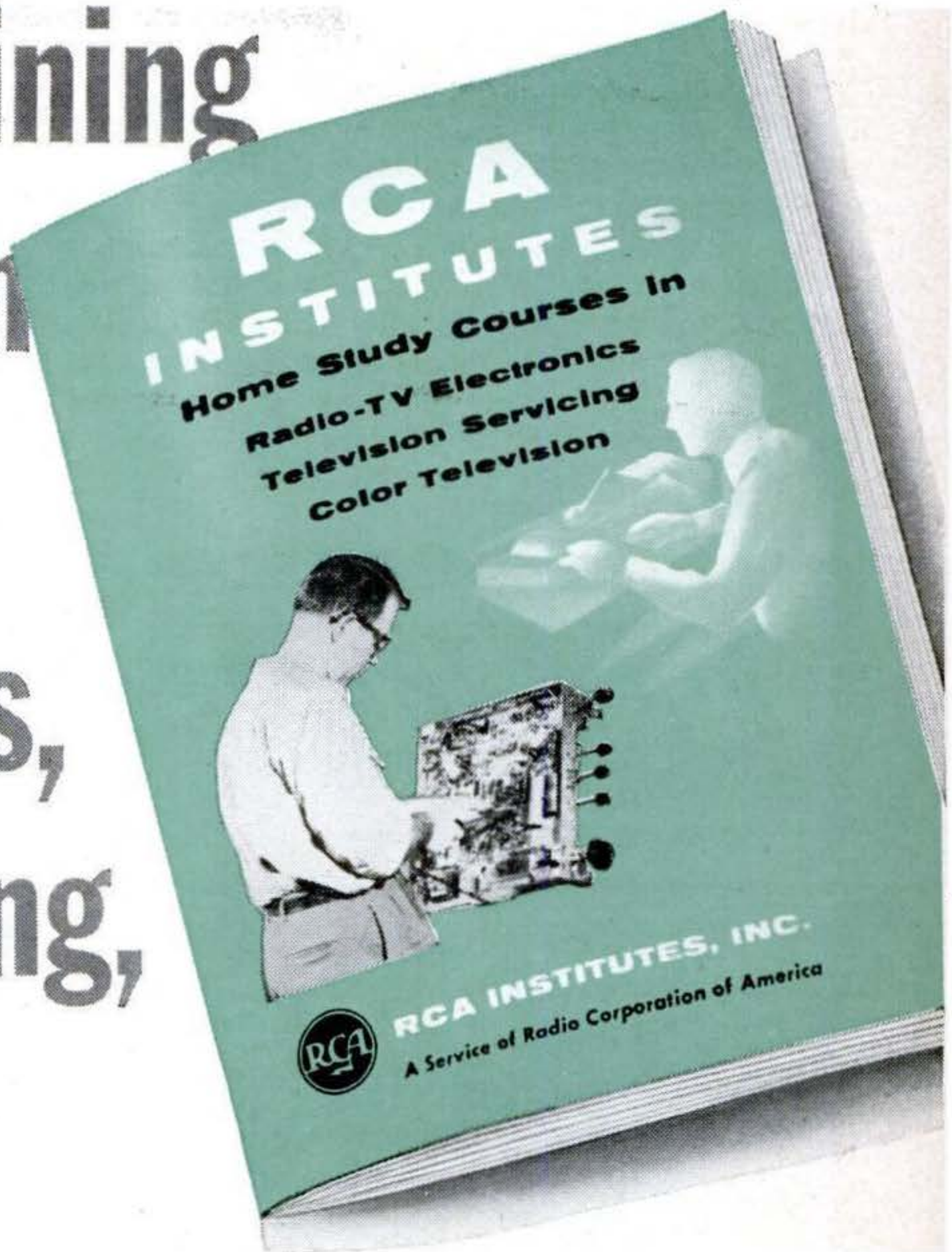

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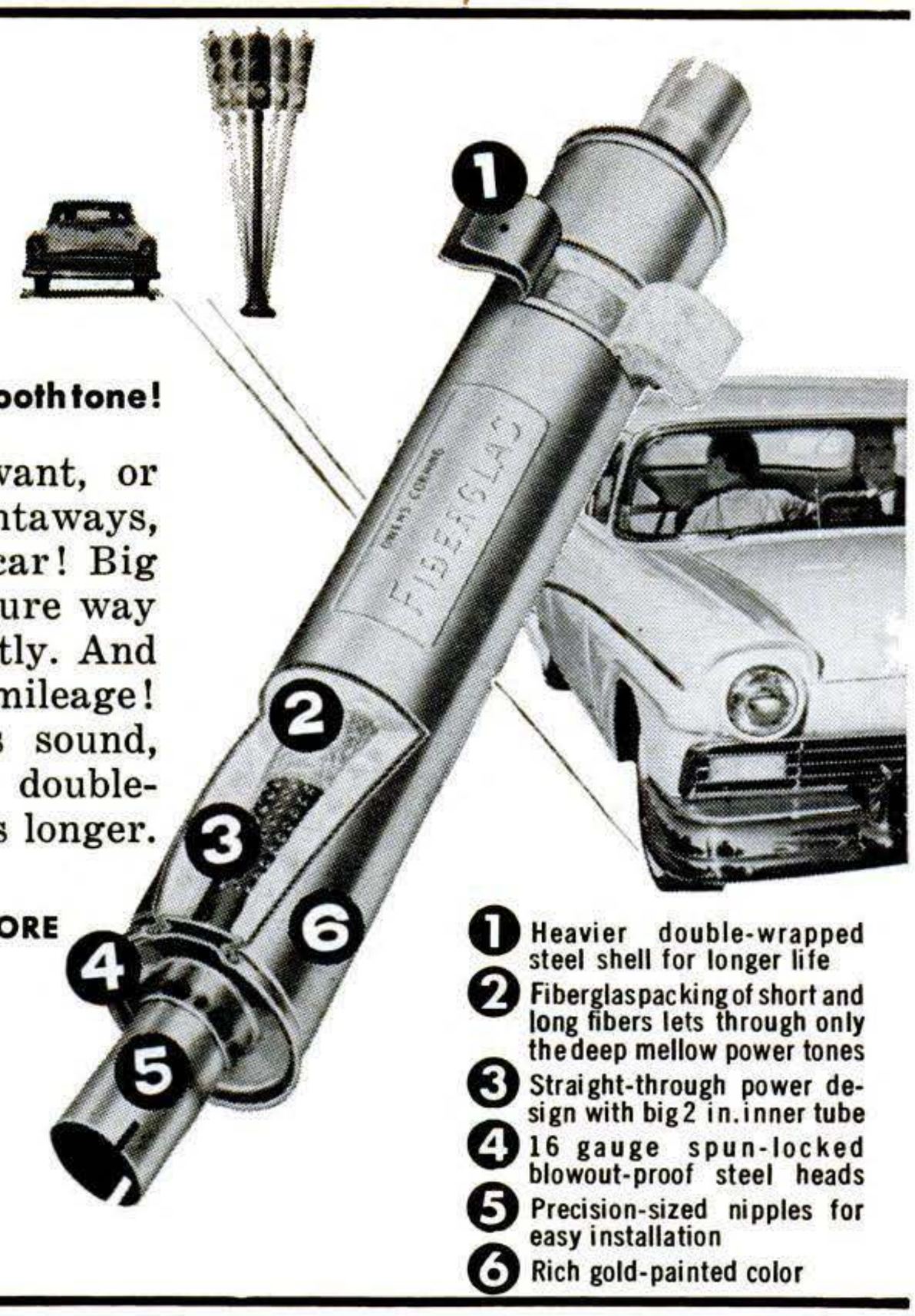

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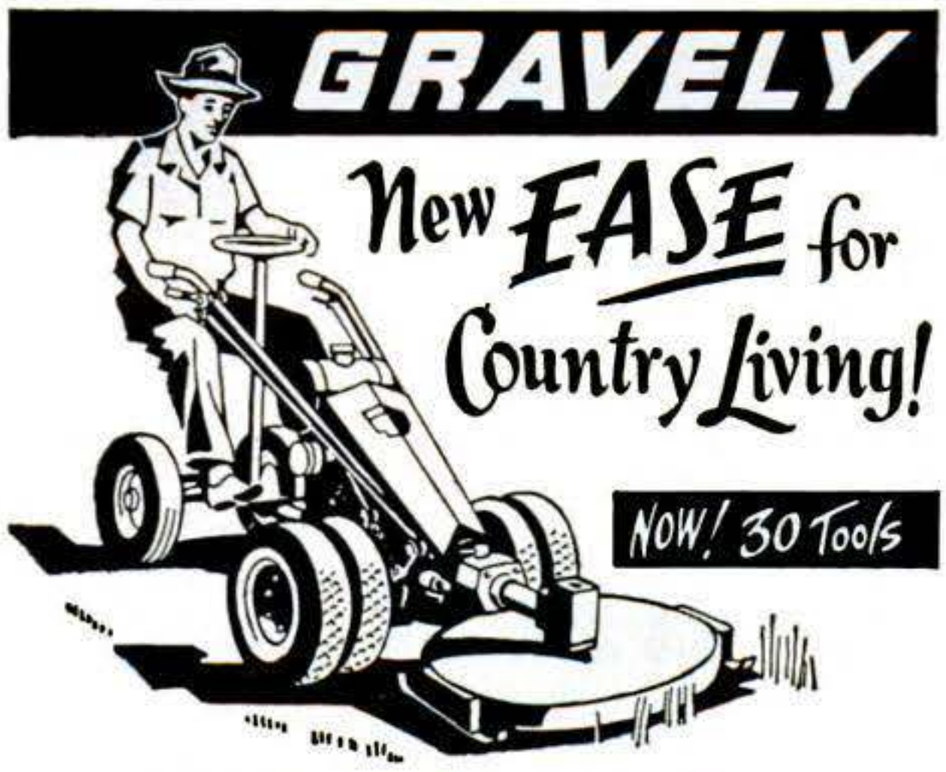

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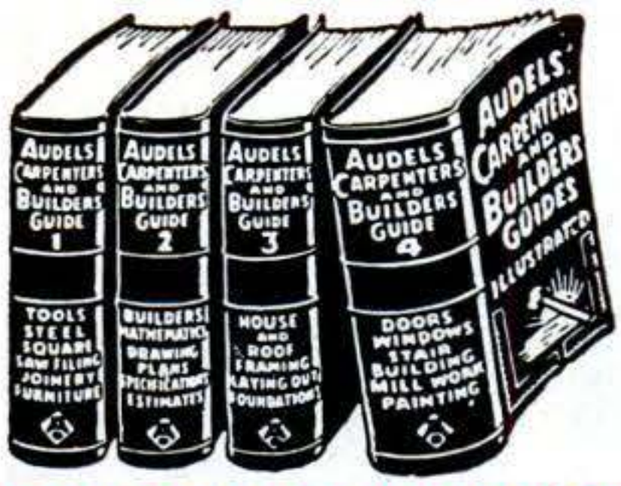

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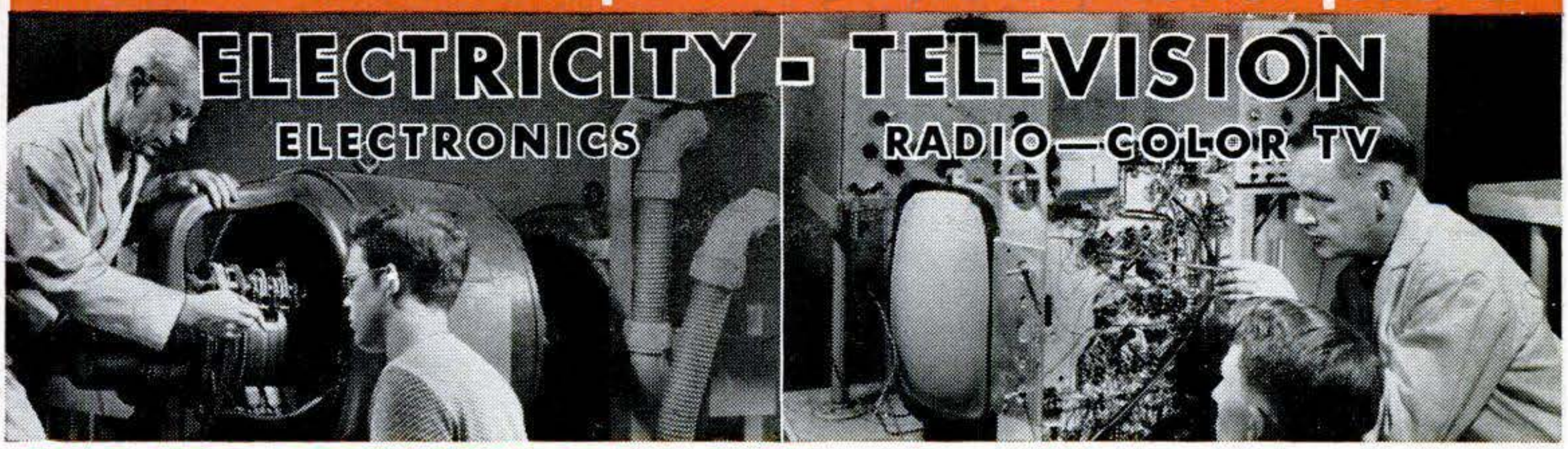

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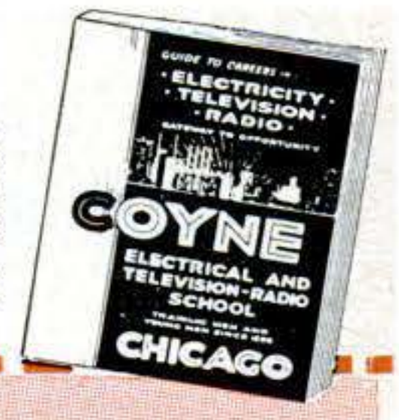

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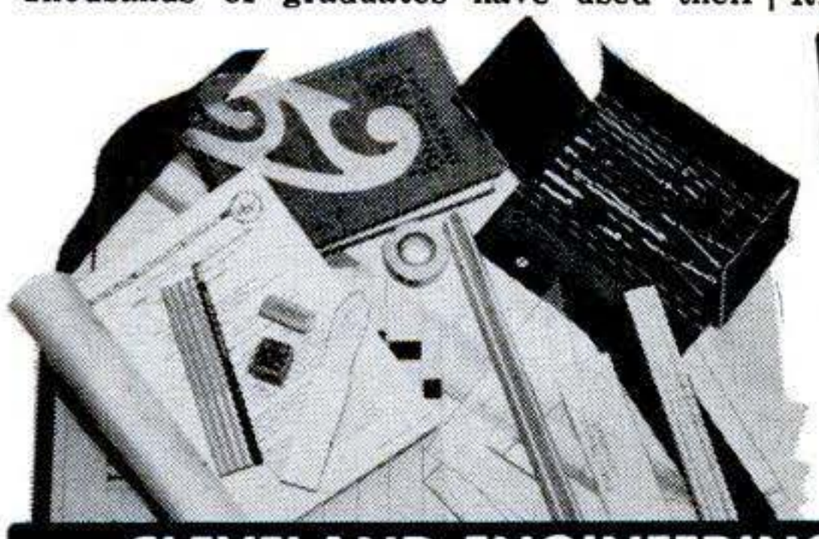

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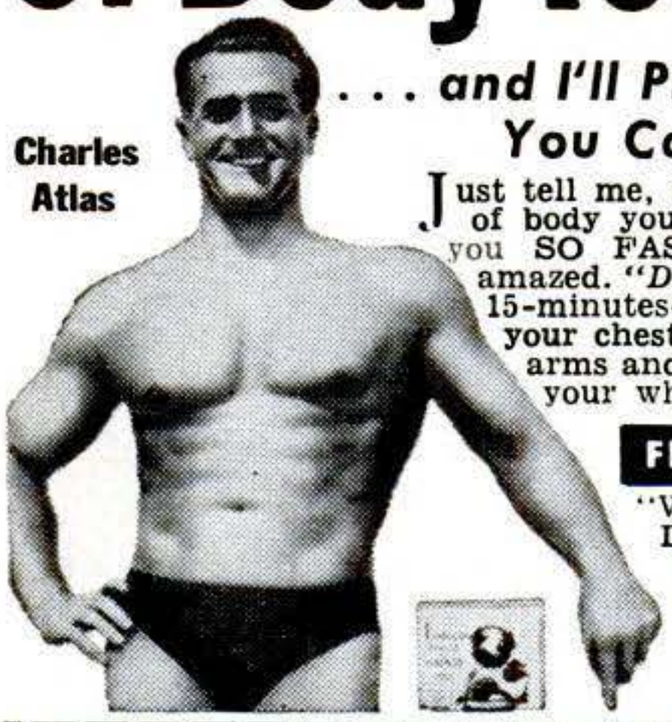

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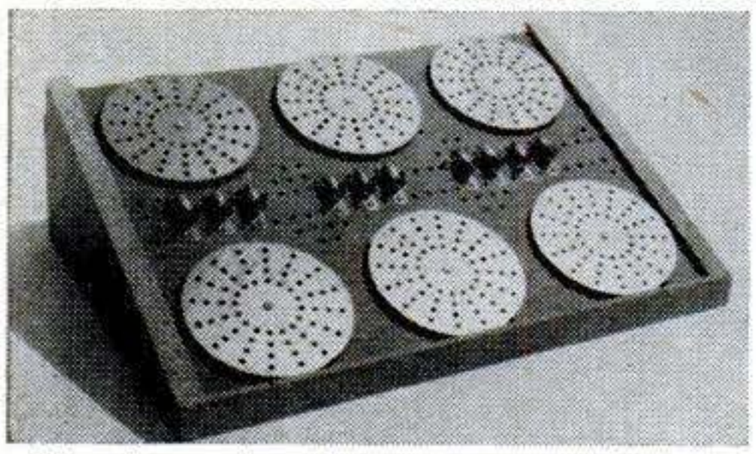

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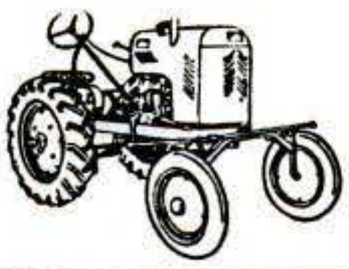

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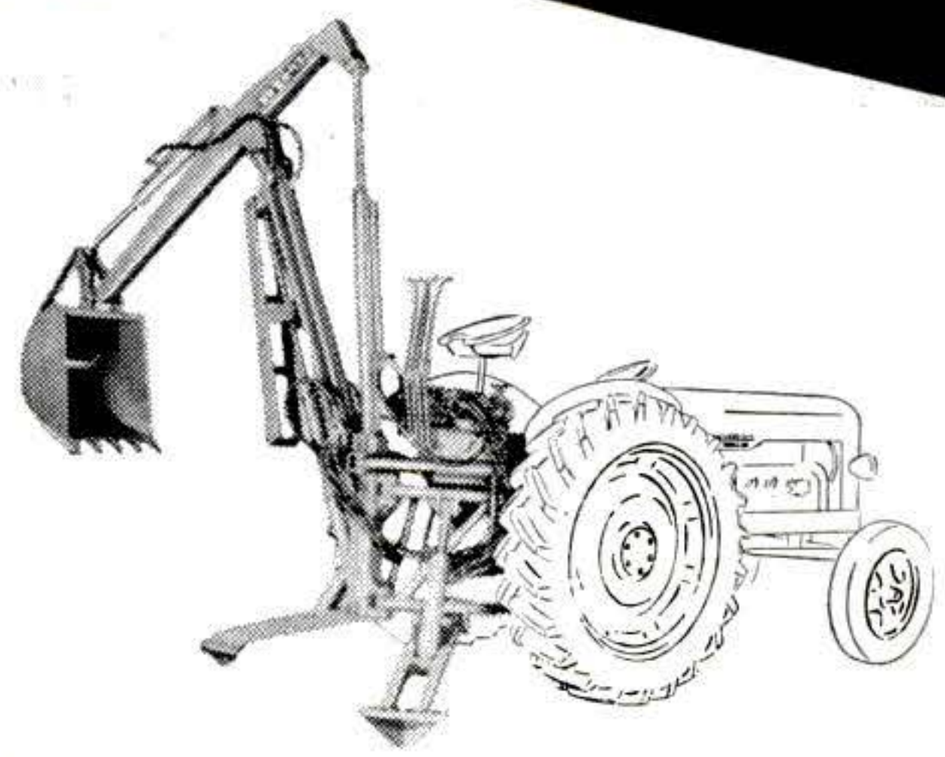

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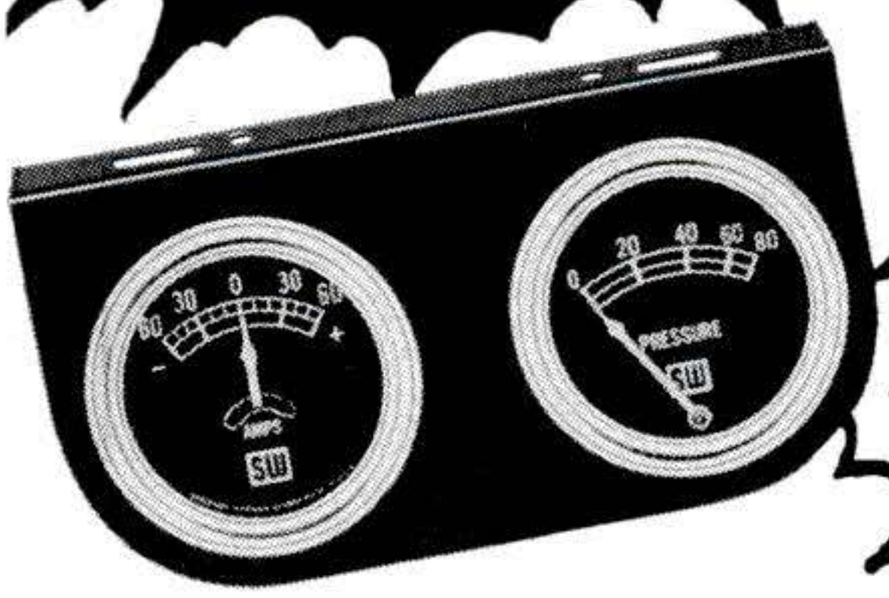

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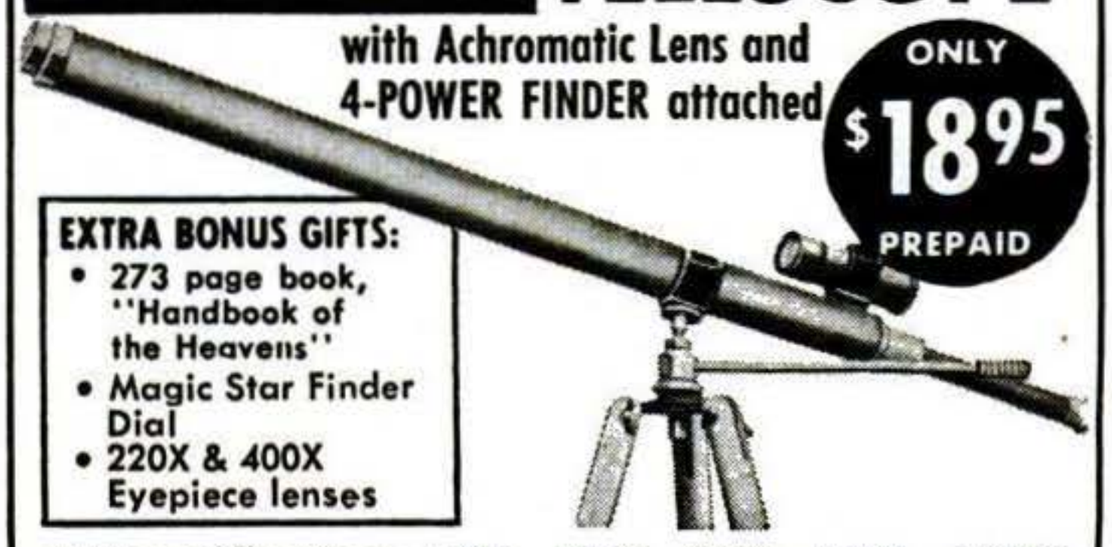

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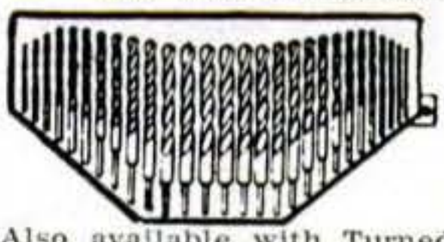

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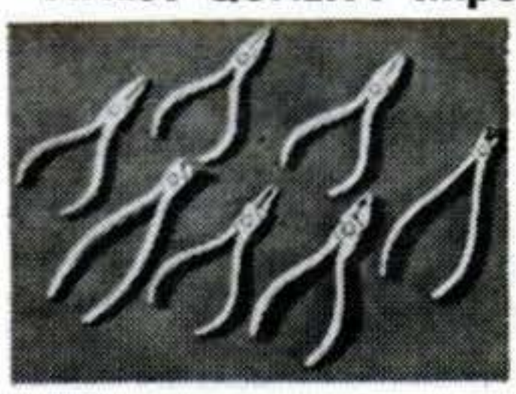

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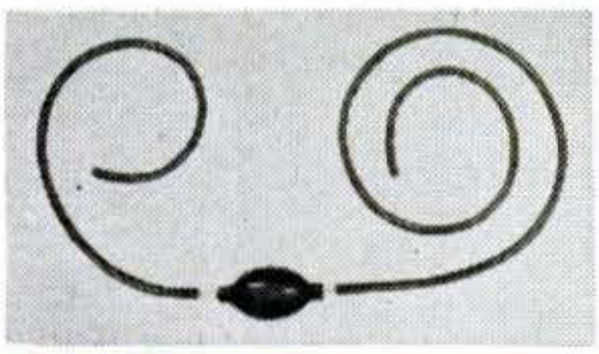

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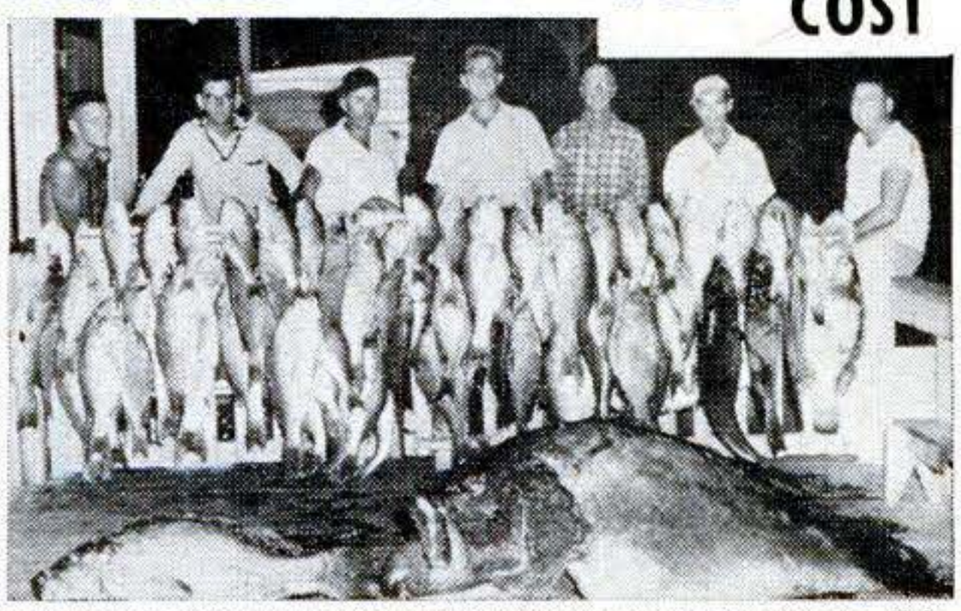

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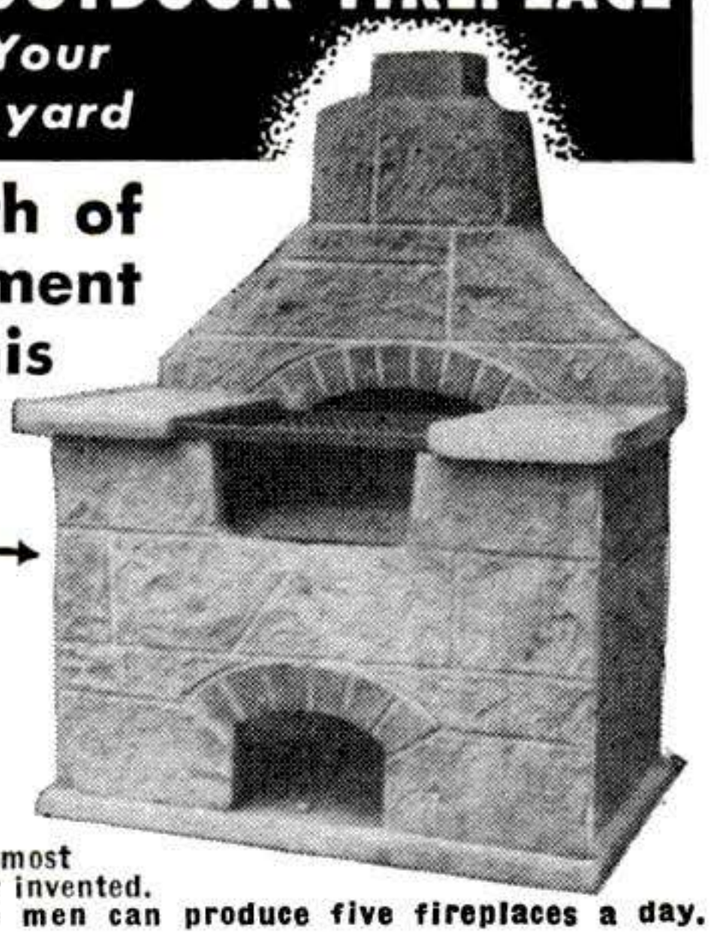

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Rubber Stamp Div., Dept. R-3-E **FREE!**
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Please rush full particulars about the little machine that can get me started in the profitable Rubber Stamp business at home in spare time. Everything you send me is FREE and no salesman will call.

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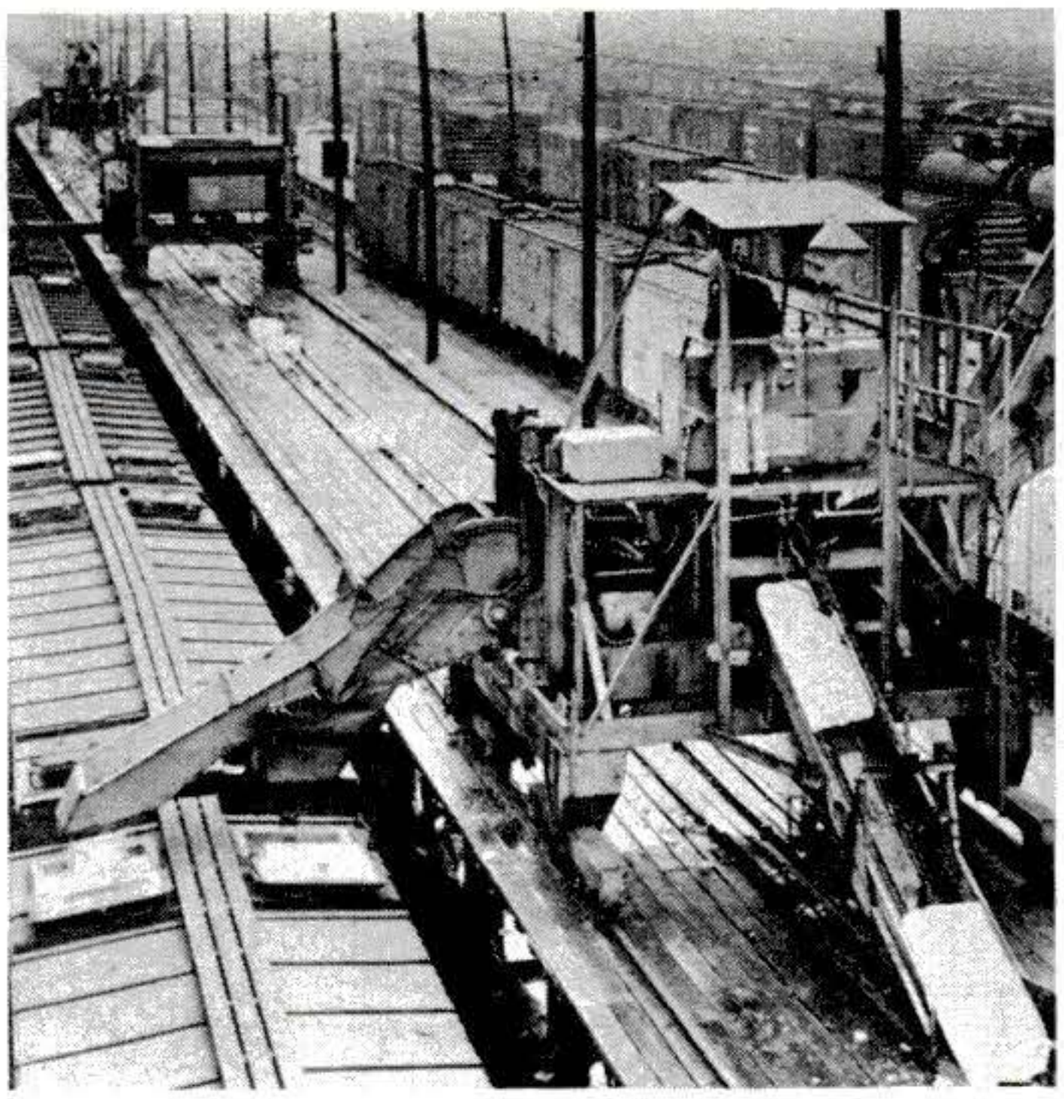

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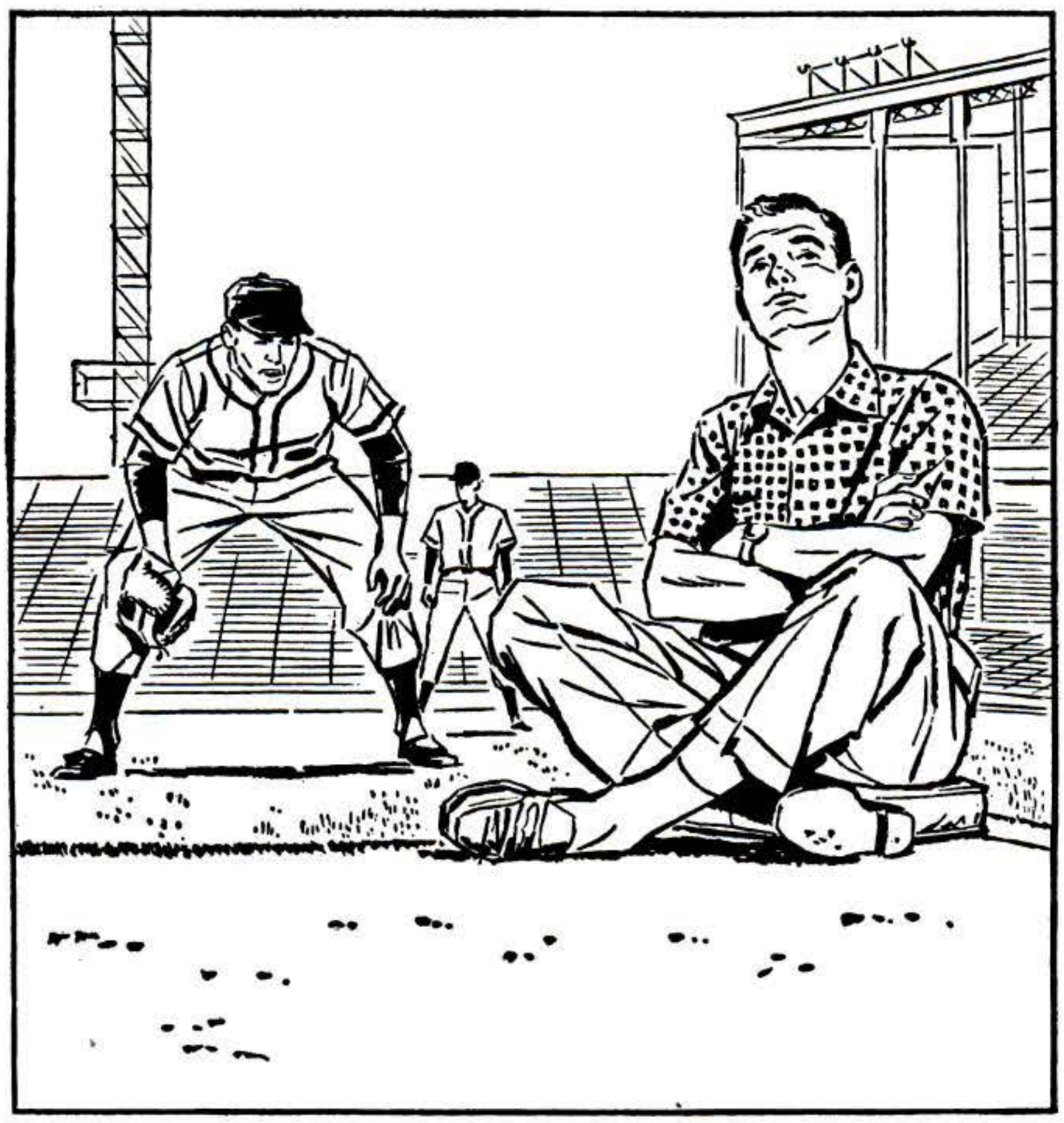

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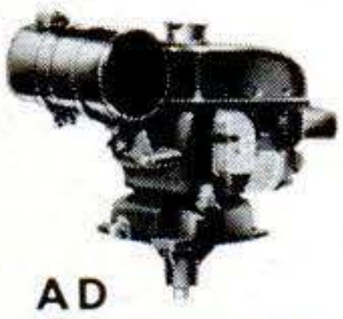

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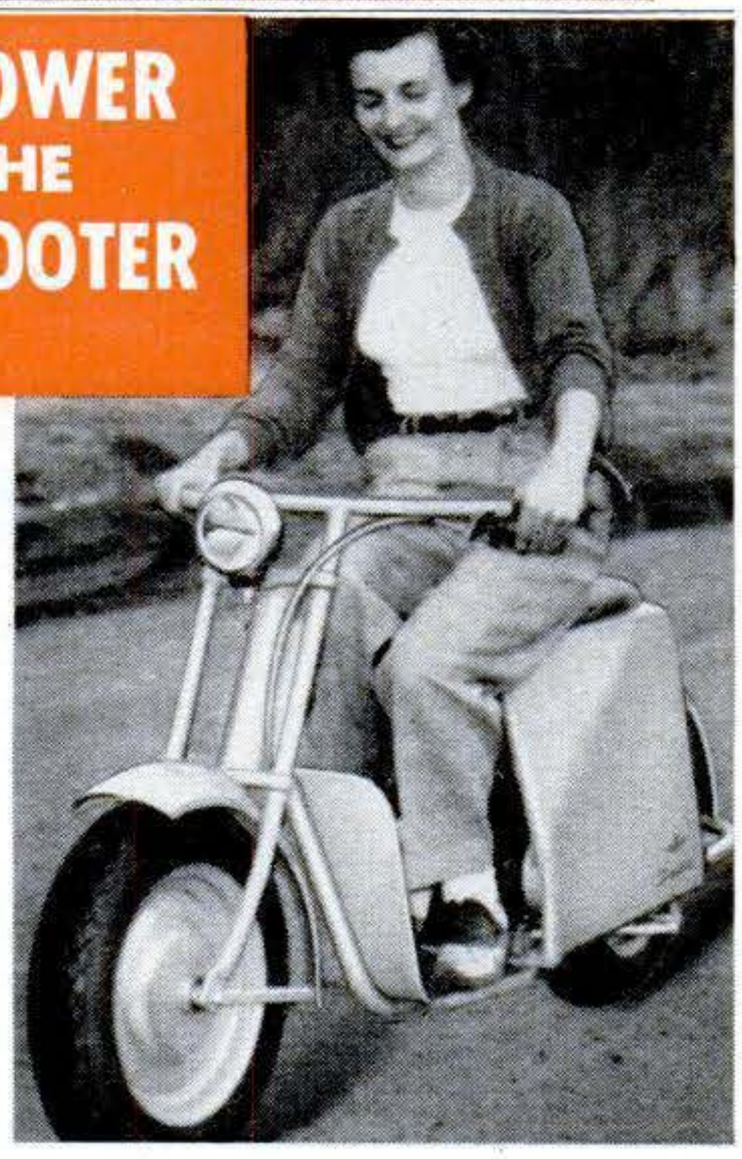

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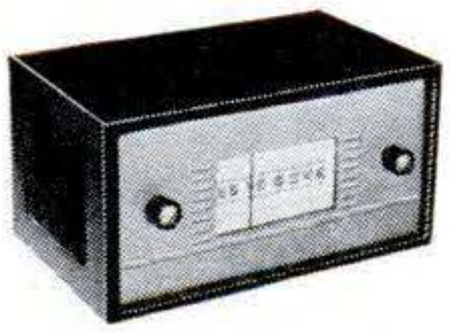

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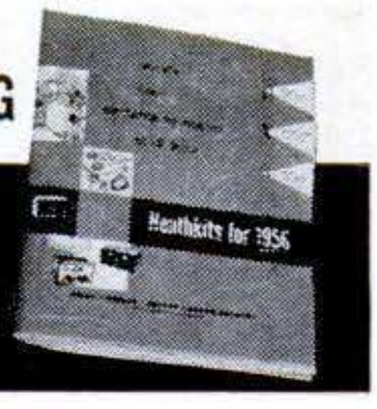

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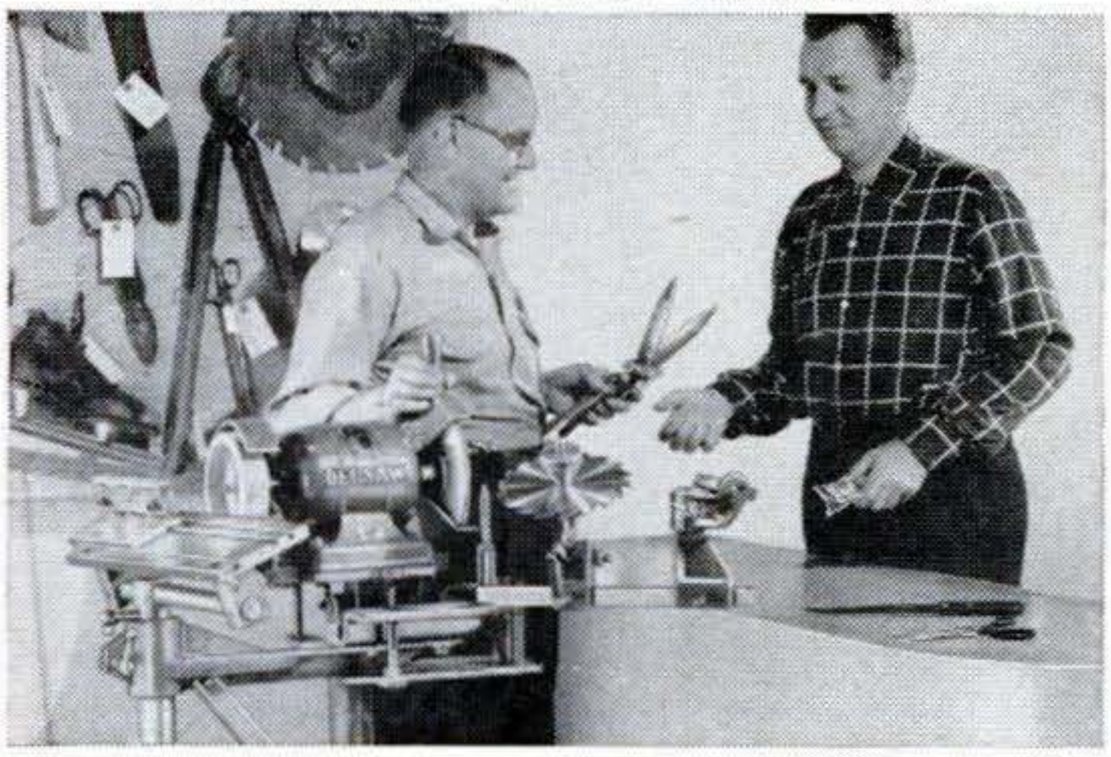

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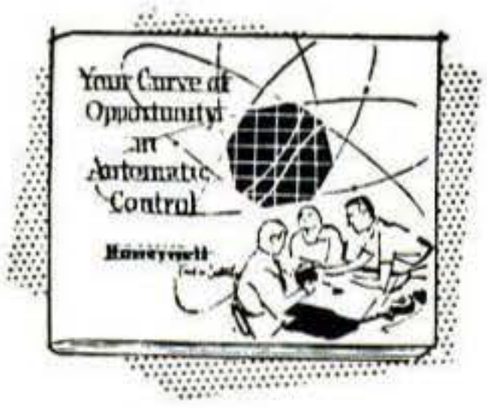

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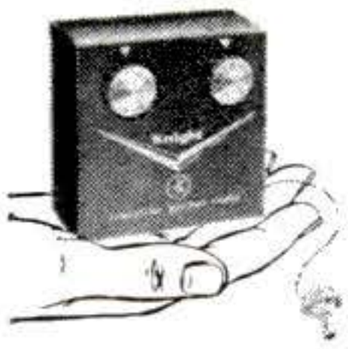

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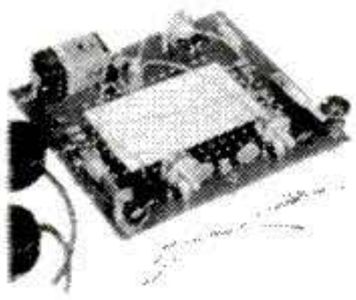

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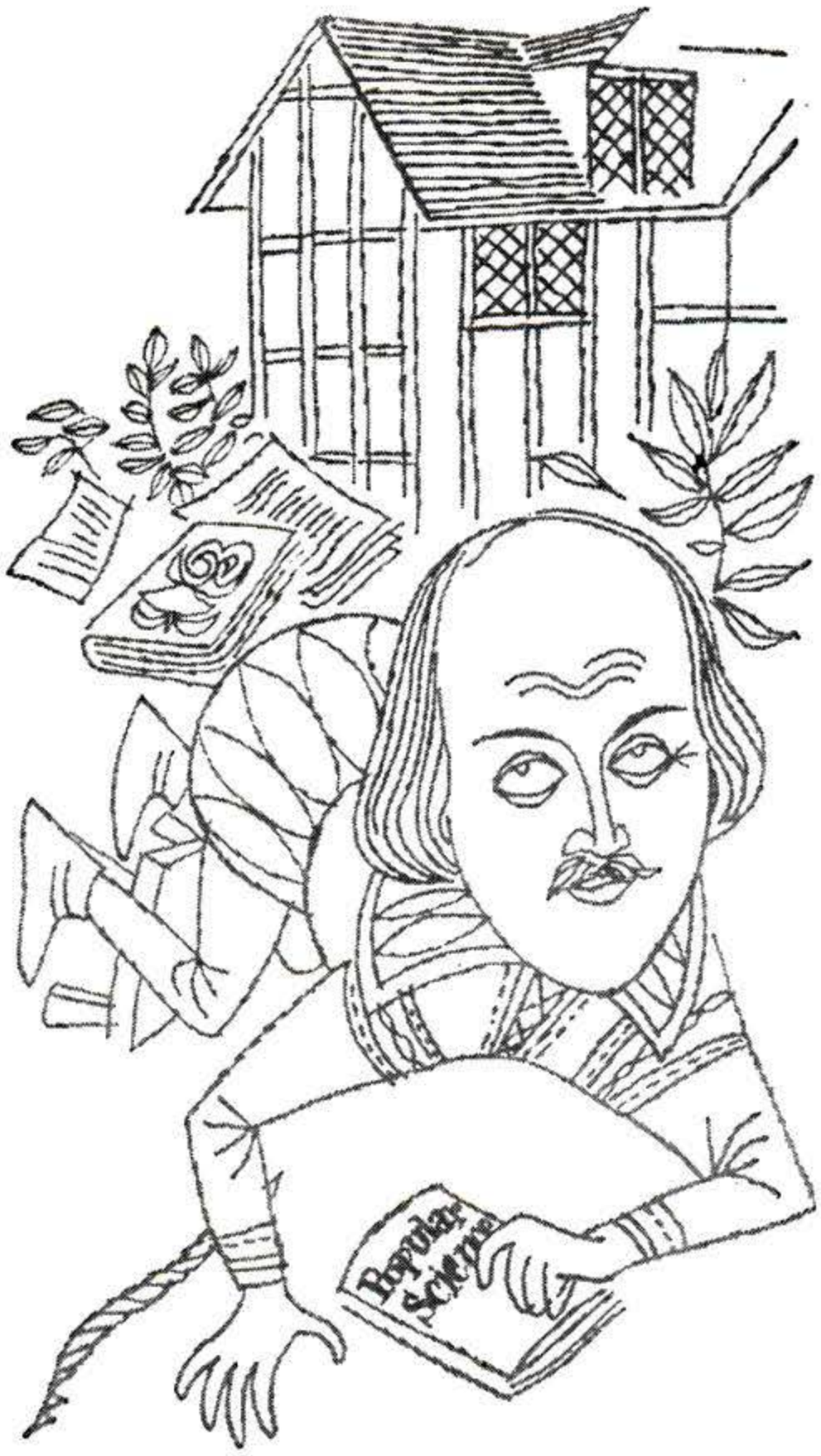

William Shakespeare said:

"THEY STUMBLE THAT RUN FAST"

We don't care if you creep, crawl, saunter, toddle toward page 187 at a turtle's pace. But be sure to get to the New Popular Science Shopping Center. There you will find a special advertising section designed to help you shop each product—its cost—and even use a new device that can get you more information on products and services you want to know more about. Take your own sweet time, be poky, painstaking—but be sure to get to Popular Science's New Shopping Center on page 187.

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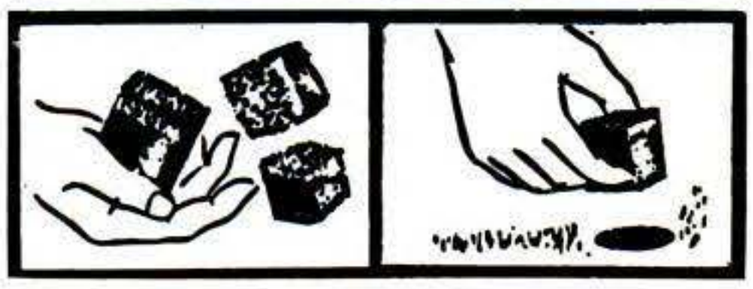

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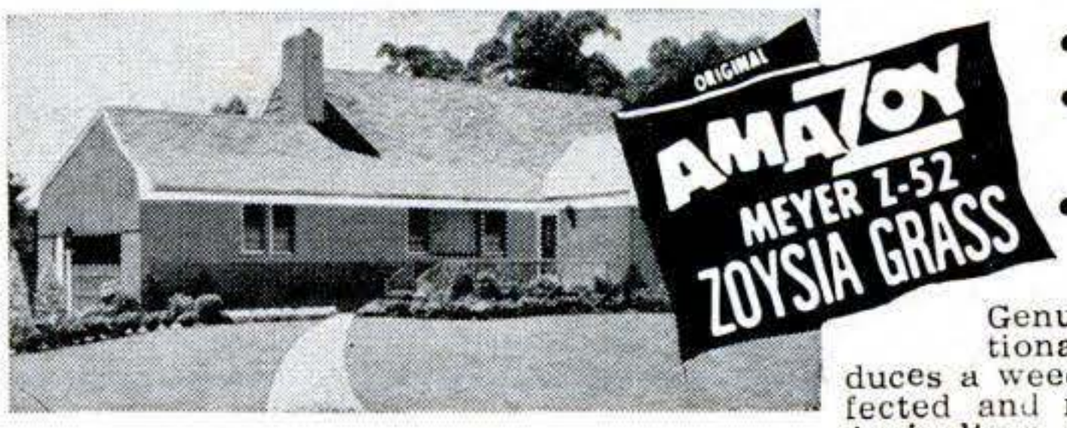

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Don't cheat your child of a chance for betterment in the years ahead, Inquire of your high school principal, math or science teacher or any well-known engineer in your community for guidance. To help you—Be sure to read the article entitled "IS YOUR YOUNGSTER A BUDDING SCIENTIST OR ENGINEER?" in this issue. This important message begins on page 60—and is part of a continuing series appearing in every issue of POPULAR SCIENCE MONTHLY.

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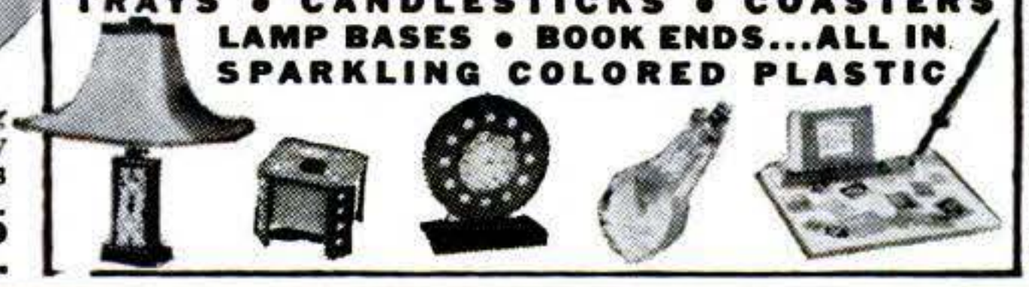

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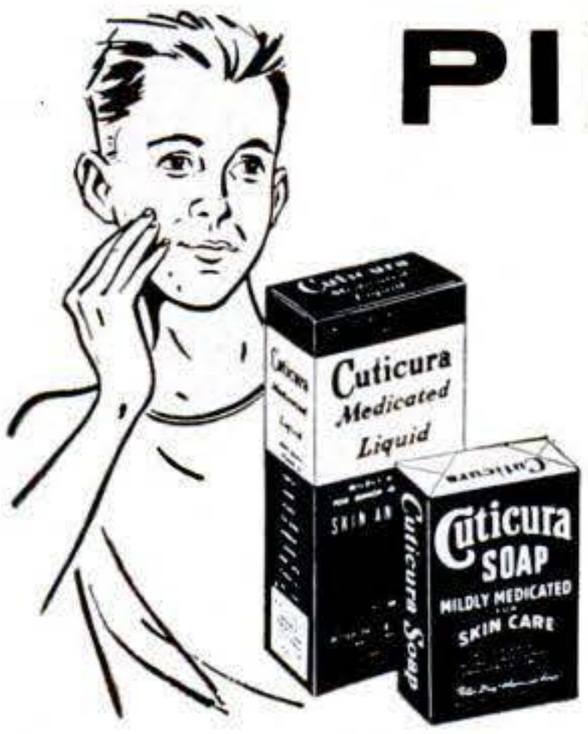

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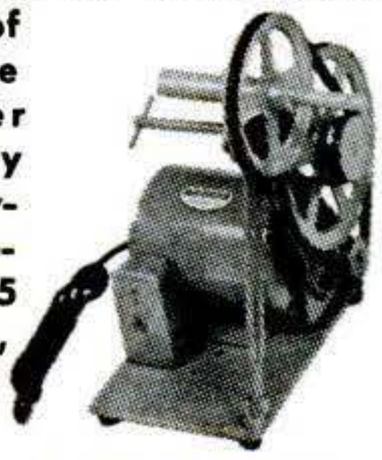

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Try the test below and determine the extent of your contact with the machine age.—*James S. Sweeney.*

1 .410, 28, 20, 16, 12, 10

2 6SN7, 6AQ5, 12SA7, 35Z5, 117Z6

3 127, 120, 116, 616

4 10", 12", 14", 16", 17", 19", 20", 21", 24"

5 20/20, 20/30, 20/40 . . . 20/n

6 8/0, 6/0, 4/0, 2/0, 1/2, 1, 1-½

7 40, 60, 75, 100, 150

8 3.5, 4.5, 6.3, 8, 11, 16, 22, 32

9 6.00, 6.50, 6.70, 7.10, 7.60, 8.00

10 10, 20, 30, 10W-30, 20W-30

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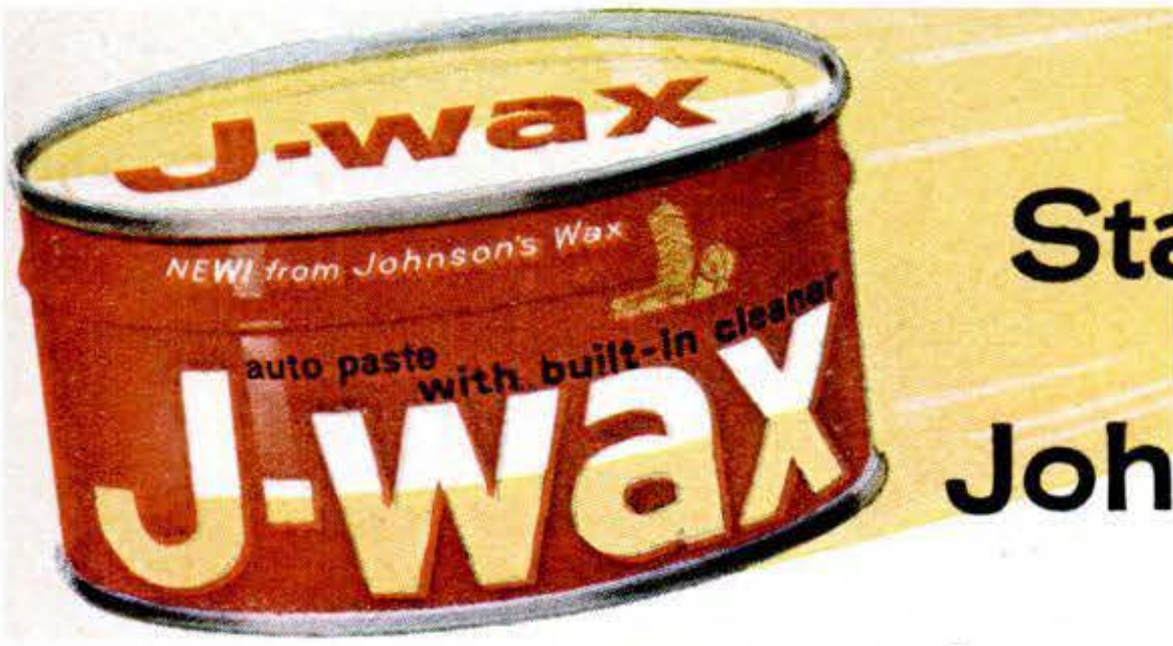

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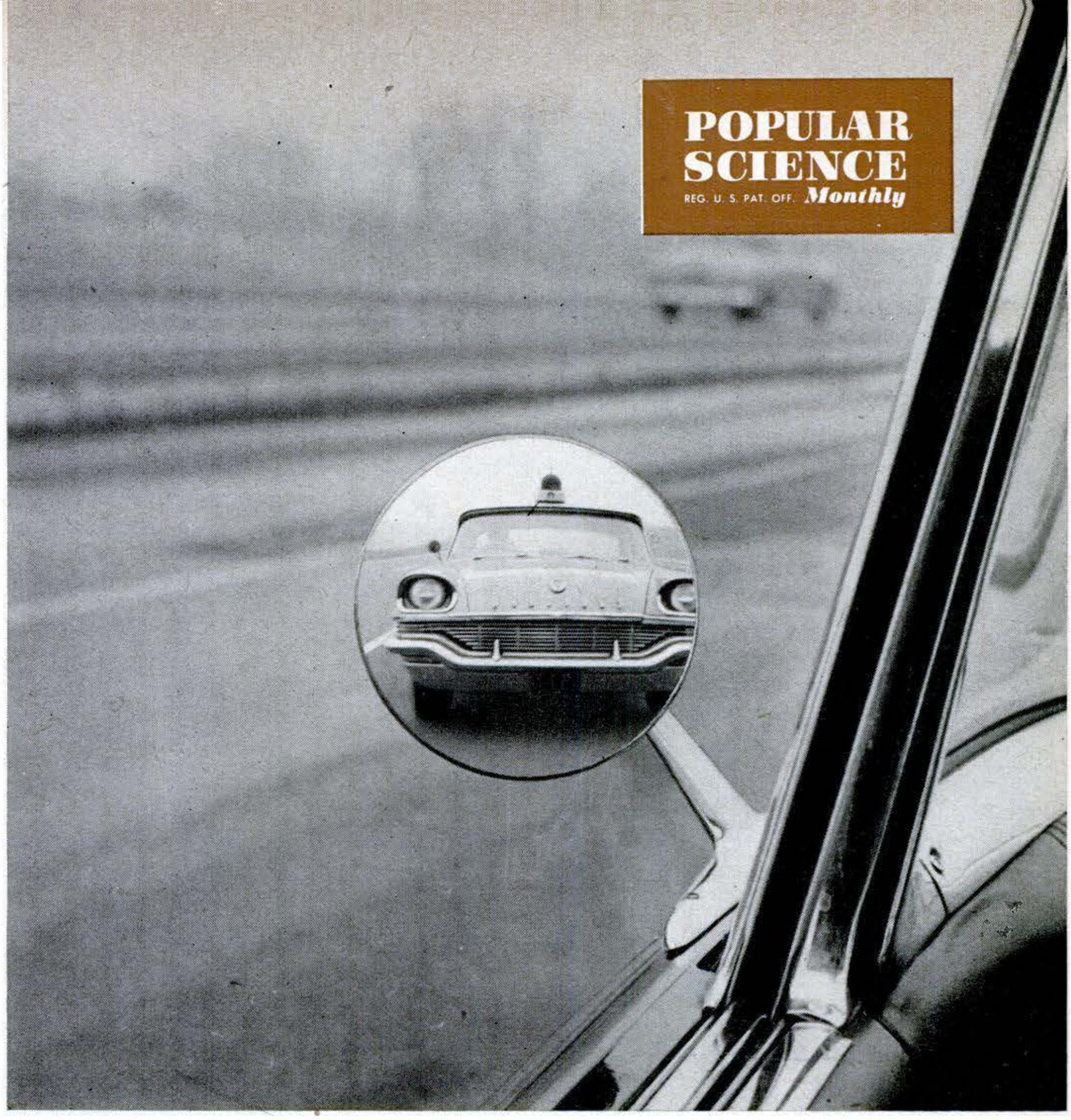

Why You Can't Outrun the Police

Some speeders try it but few beat the game. Here's why it doesn't pay to play tag with the cops.

By Harry Walton

BREEZING along on the wrong edge of the speed limit, you spot a police car following. Probably your first reaction is to ease up on the gas. But maybe, for one reckless moment, you think of floorboarding it.

That split-second decision is a loaded one. After talking to state-police officials, reading official reports, and riding many patrol tours with troopers on the road, I feel qualified to offer one piece of advice: Don't try it.

Racing the cops is a sucker's game. Its odds are so bad as to appeal only to the driver who is a dope or a fugitive. The average John Doe—even if he al-

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Runaway speeders are betting their lives—with the

ready has a bad-driving record—risks far more than he stands to win.

Tilting his throttle foot downward may cost him his license, could cripple him for keeps, might kill him. It's sure to cost him more than if he pulls up.

But some people do try to outspeed the law. Very, very few of them get away. Here's what they are up against:

- A superior car. The modern police car will outspeed and outcorner most stock models (with the exception of some sports cars). It's usually in better condition than the speeder's.
- A better driver. The trooper at the wheel gets plenty of practice; he drives an average of 4,000 miles a month. He knows the roads, and is familiar with the behavior of his car at 100 m.p.h. and more.
- Electronic assists. Nothing with wheels can outspeed a radio alert. If the cop behind a speeder can't stop him, those ahead can.
- That guilty feeling. The average speeder is under an enormous psychological handicap. By running away, he confirms his guilt even to himself. He is almost literally driven by desperation. Next step: panic.

Why do they run? Most citizens pull over when ordered to. "It's rarely the man in a 300-horse sedan or a sports car that we have to chase," Commissioner Joseph Childs of the Michigan State Police told me. "More often it's some fellow in an ordinary car who thinks he has a reason for running from us."

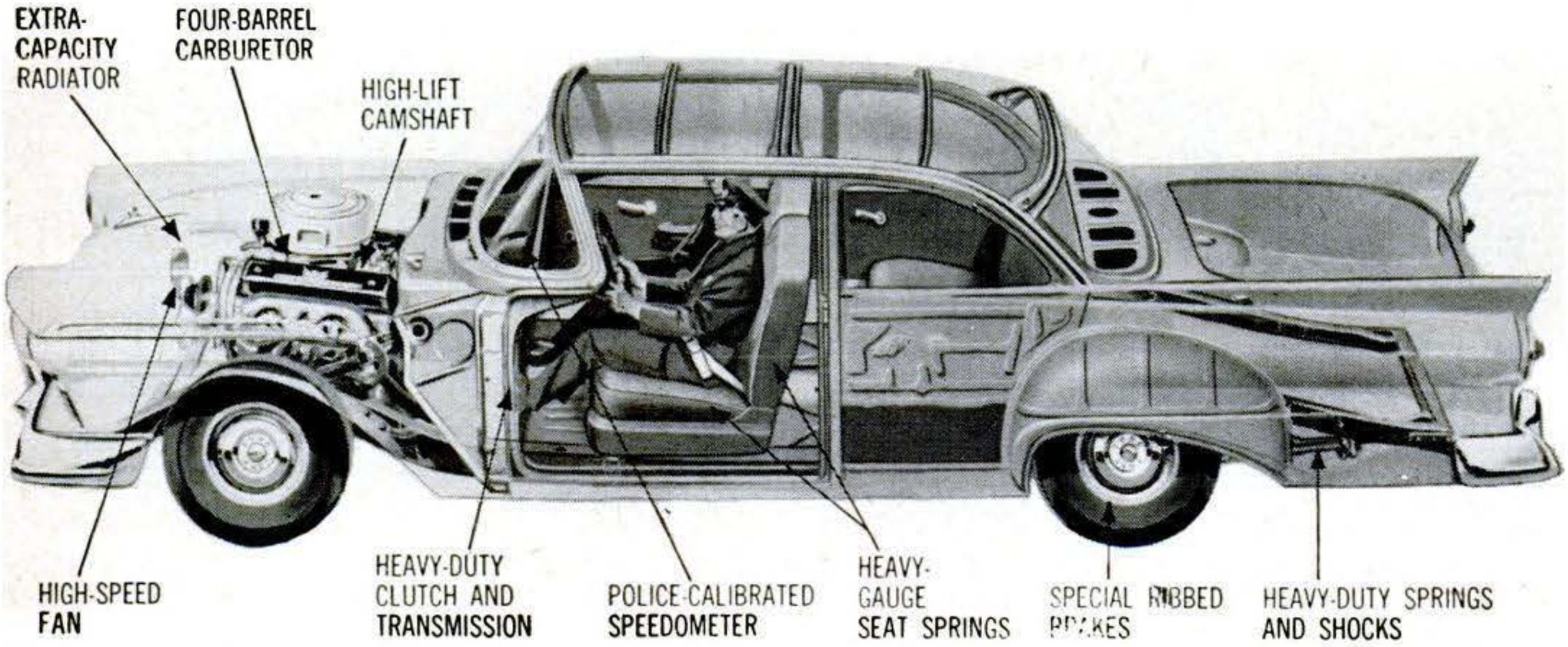
"The majority of those who try to outrun our cars," said Lieut. Burton Yungfer of the Michigan State Police, "are either wanted on criminal charges or ordinary citizens driving on revoked licenses." In Michigan, this offense carries a mandatory jail sentence.

Police may stop you for nothing more reprehensible than a burned-out tail light. But if you jackrabbit away, an officer has no way of knowing whether you are a criminal, a drunk or a wise guy. All look alike through the rear window.

He will take after you, and immediately put your license number and a description of your car on the radio. With the gas down and a cop on your tail, you're in for a fast ride. Chases at 100 m.p.h. are a daily occurrence; some hit higher speeds. The safest thing a speed-and-run driver can do is quit while he's alive.

Too many don't. Says Lieut. Louis Marchese of the Connecticut State Police, "Only too often a trooper calls in

How police cars differ from the showroom sedans



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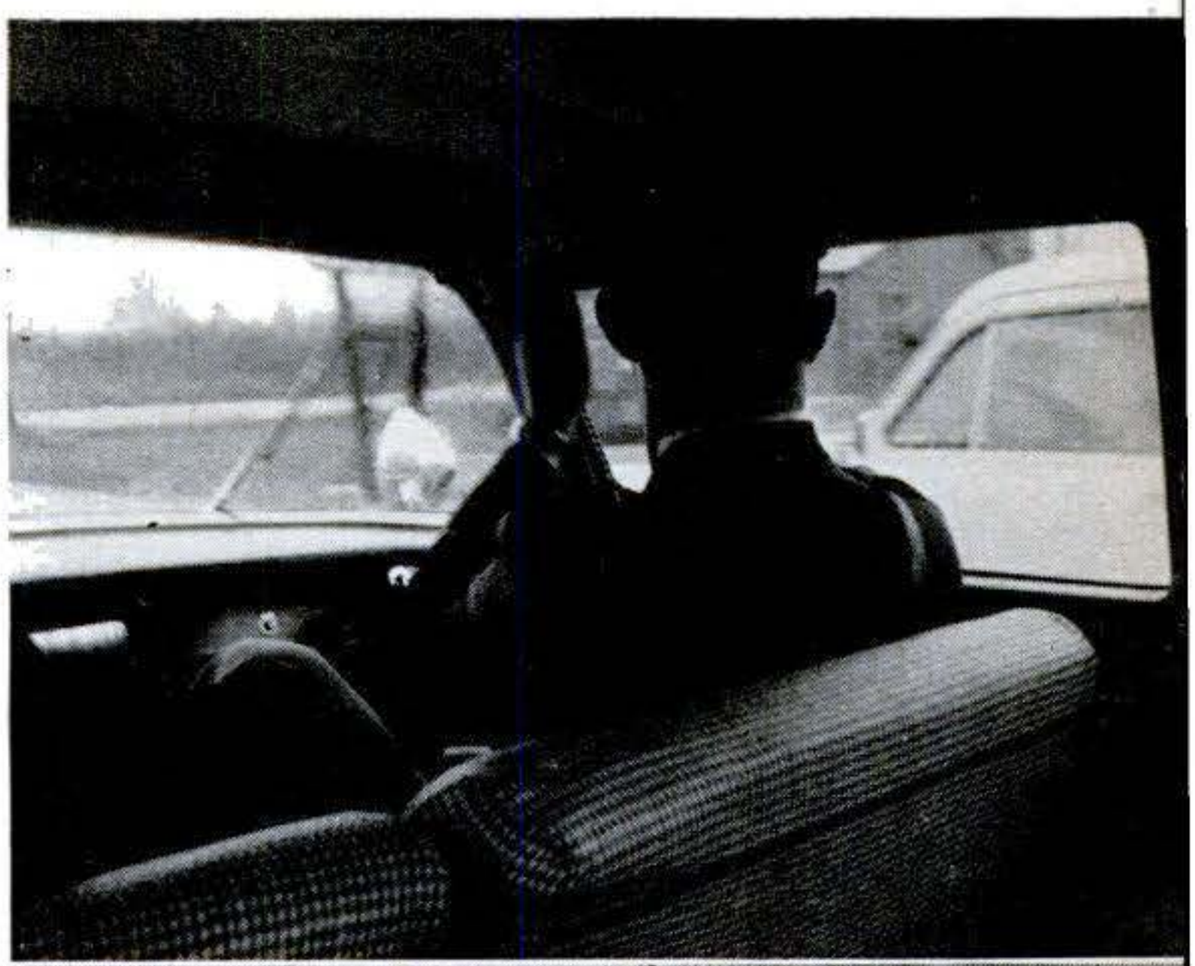
that he's chasing a car, and then breaks off to say, 'There he goes over.' I'd say that 75 percent of those who run away from us wind up in a crash."

Don't blame the cops for accidents like that. Troopers try not to panic a driver (sirens, for example, are used only as a last resort in Michigan and Connecticut). But when a motorist runs away, the trooper is forced to assume he has a criminal motive, and gives chase.

His superiors frown on high-speed chases that aren't absolutely necessary. "No speeder is worth risking life for," one Connecticut official told me, "though of course we will go all out to get a known criminal." Said an executive of the New York State Police: "Two speeding cars only double the danger to all other traffic. We instruct our men to intercept by radio rather than chase another car at 100 m.p.h."

In Michigan, too, troopers are instructed to radio ahead if the pursuit gets hot. Sometimes it's the only way. Some months ago, the same sports car was clocked time and again at 130 m.p.h. on the New Jersey Turnpike—too fast for troopers to overhaul. Finally a trap was set; several police cars, alerted by radio, pulled onto the highway ahead of the sports car at high speed, and then gradu-



OFFICER'S PULL-OVER GESTURE may be reinforced with a siren signal or flashing light. Approved technique calls for the police car to stop behind the offender's car. Officer stands back of driver's window, making it difficult for driver to cover him with a gun. Second officer covers the first from the right rear fender.

City police may use standard stock models, perhaps the same as the car you own. But the cars that state and throughway police drive only *look* similar to the car you drive. Their innards are rakishly different.

Engines are souped up with multibarrel carburetors and high-lift cams. Radiators, clutches, transmissions and other parts are beefed up for heavy service. Extra brake capacity and stiff springing give the cars a cornering ability that many of today's Softspot Specials cannot hope to equal.

Said a commissioner of state police: "On a straightaway we may have a long chase, but once a speeder tries to corner away from us, we've got him."

Cars with heavy-duty parts for police service are offered by Ford, Chrysler, Mercury, Pontiac, Dodge and Oldsmobile. You can't buy one without proof that you work in a law-enforcement organization.

To keep up with the multiplying horses under the hood of John Citizen's car, police trade in their cars every year or two. In 18 to 24 months on the highway, the average patrol car rolls up 60,000 miles.

Wheel-spinning starts, savage braking and high speeds on all kinds of roads wear rubber fast. Rear tires may give troopers only 10,000 miles of service. For safety's sake, any tire showing a flaw must be discarded. Tires are typically run at 28 lb. pressure; the extra hardness affords a trifle more speed, cuts tire squeal on curves, and reduces wear. Some traffic departments balance all four wheels before a patrol car is allowed on the road.

Rugged use is tough on clutches and transmissions. With the idea of reducing maintenance costs, some police units are trying automatic drives. Troopers look at the clutchless floor with misgivings, shrug, and go about their patrol duties as usual.

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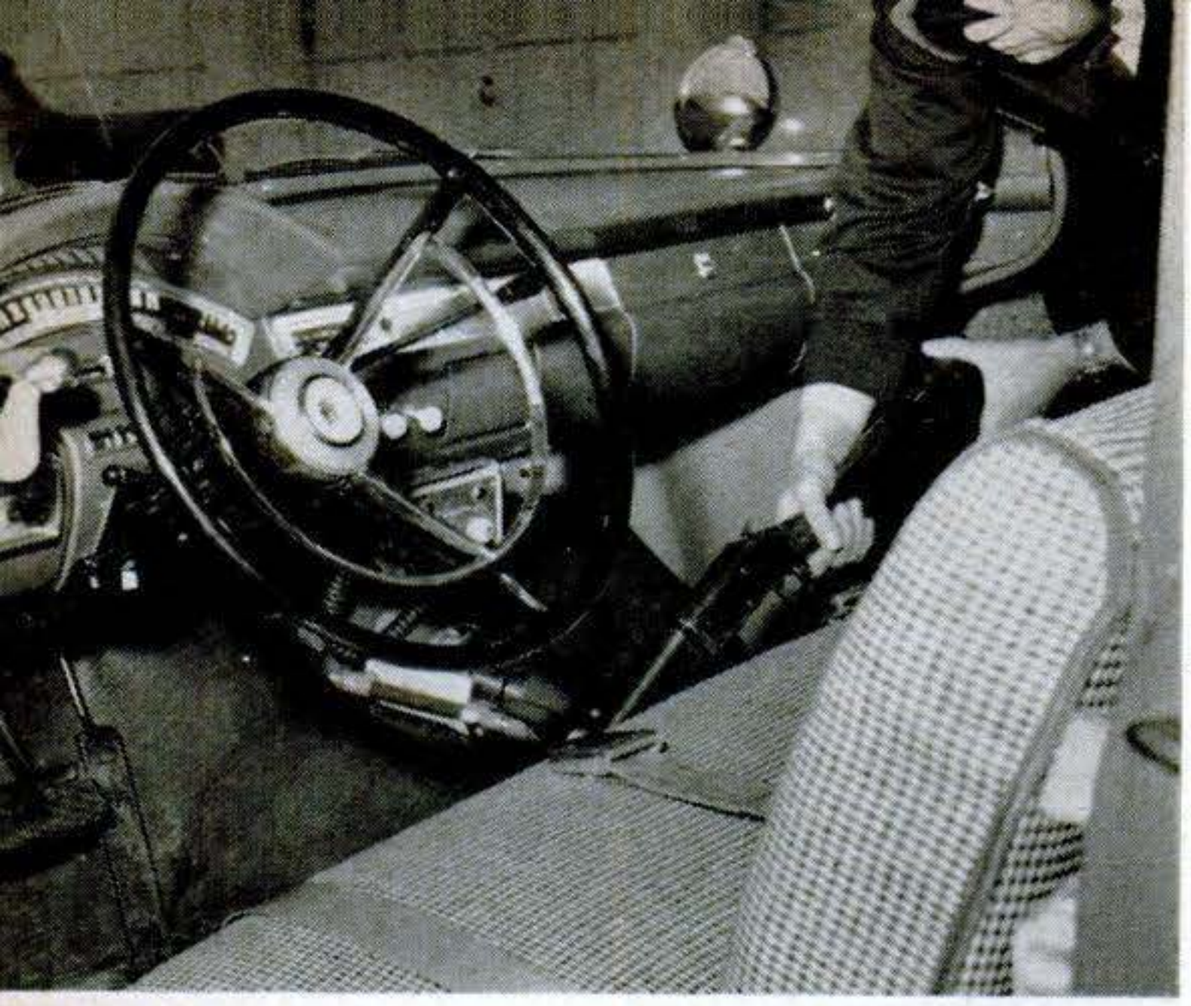

STARTING OUT ON PATROL, Michigan Trooper Christian Walters slips his shotgun into its seat holster. The car is equipped with seat belts for two. Most troopers use them willingly.

THIS IS A ROADBLOCK. Police car is off the highway but pointing down it. Michigan Trooper James Echols stands by with shotgun to cover companion as he stops and checks cars through.

YOU CAN'T ARGUE with police-car speedometers. Some of them are specially calibrated by the manufacturer. Michigan State Police check theirs out with a fifth wheel, as shown below.

ally slowed down, forcing it to a halt.

Will police shoot? It depends where you run. Police in Bensalem township, Pa., were recently ordered to shoot when necessary to stop speeders. In Connecticut, troopers will fire only if the speeder is known to be a criminal, and then only if he fires first. Other states permit officers to shoot at a runaway speeder's tires.

Conscientious cops are reluctant to shoot; they will try to scare a driver first by brandishing a gun or firing into the ground.

At 5:30 p.m. last Labor Day, Michigan State Trooper George Mansmith saw a '51 Pontiac pass a car on a hill at high speed and stay in the left lane all the way to the top. Mansmith gave chase. Fishtailing wildly, the Pontiac cut in and out at over 80 m.p.h., running on the wrong side of the no-passing line and forcing several oncoming cars off the road as it passed those in its own lane. Mansmith turned on his siren and drew abreast; instead of stopping, the speeder forced him off the road. Brandishing his gun, Mansmith made another attempt; at 90 m.p.h., he found himself facing an oncoming car and had to run off the left shoulder into a culvert.

But his car kept its feet. Mansmith pulled out of the culvert and got up to the Pontiac again. Either discouraged or alarmed by sight of the gun, the speeder now pulled off the road and quietly took the ticket Mansmith handed him. He drew a large fine and a jail sentence.

Even gunshots won't always stop them. On a clear, dry night, a '56 Cadillac passed Michigan Trooper Ernest Nash going at a high speed in the opposite direction. Nash swung around. The Caddie opened up to 115 m.p.h. Nash radioed ahead, but the car suddenly turned off onto a secondary road. In open country and with no other cars near, Nash tried unsuccessfully to shoot a tire. The chase went on until the road took a series of sharp curves. Then the speeder pulled up. His license was in order. "Sure I knew a trooper was after me," he admitted. "Just thought I could

[Continued on page 244]

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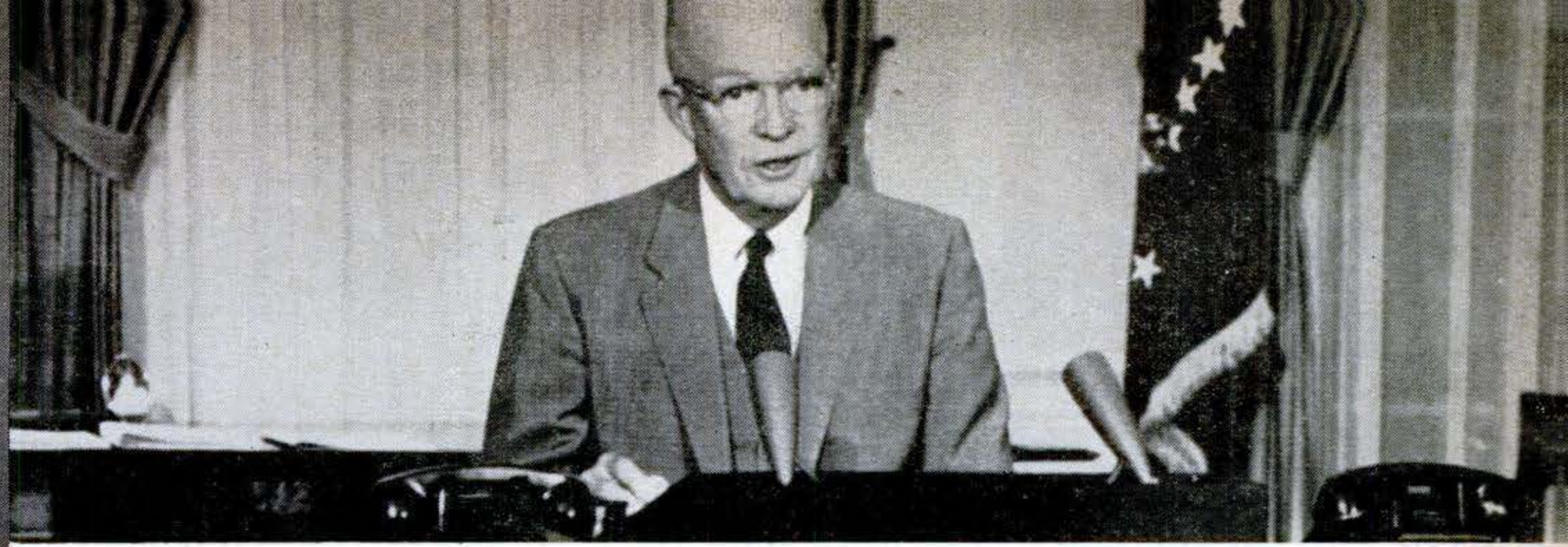

TELEGRAM

The White House
Washington

Popular Science
353 Fourth Avenue
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To the staff and readers of Popular Science Monthly, joined in the observance of the eighty-fifth anniversary of their magazine, I send greetings.

As you advance the understanding of science and mechanical matters in this country you perform a splendid public service. I am sure Popular Science Monthly will continue to play its part in stimulating interest in the opportunities of our modern age and thereby help to meet the Nation's present and future needs for more scientists and engineers.

Congratulations and best wishes.

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Lindbergh's Amazing Airplane

The little monoplane in which he made his historic flight 30

By Eliot Tozer

AS MOVIE marquees throughout the nation are reminding you this month with their "Spirit of St. Louis" hoopla, it was just 30 years ago that "Lucky Lindy" made the Big Hop. He did it in a truly remarkable plane. For the Spirit of St. Louis was a full decade ahead of its time.

Actually, the plane almost didn't get off the ground at all. By February, 1927, Lindbergh had been rebuffed in his search for a plane by Bellanca, Fokker, Travel Air and Columbia. Bellanca insisted that no single-engine plane

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years ago this month was far ahead of its time.

could fly the Atlantic; Lindbergh believed that only a lightweight, single-engine plane could make it. Fokker wanted $100,000 to build a plane to Lindbergh's specifications; Lindbergh had only $15,000 to buy the plane and make the entire flight.

On Feb. 23, 1927, Lindbergh walked into the office of Ryan Airlines on Juniper St., San Diego, Calif., and within hours signed a contract.

Lindbergh knew what he wanted when he sat down

Charles A. Lindbergh before 1927 flight

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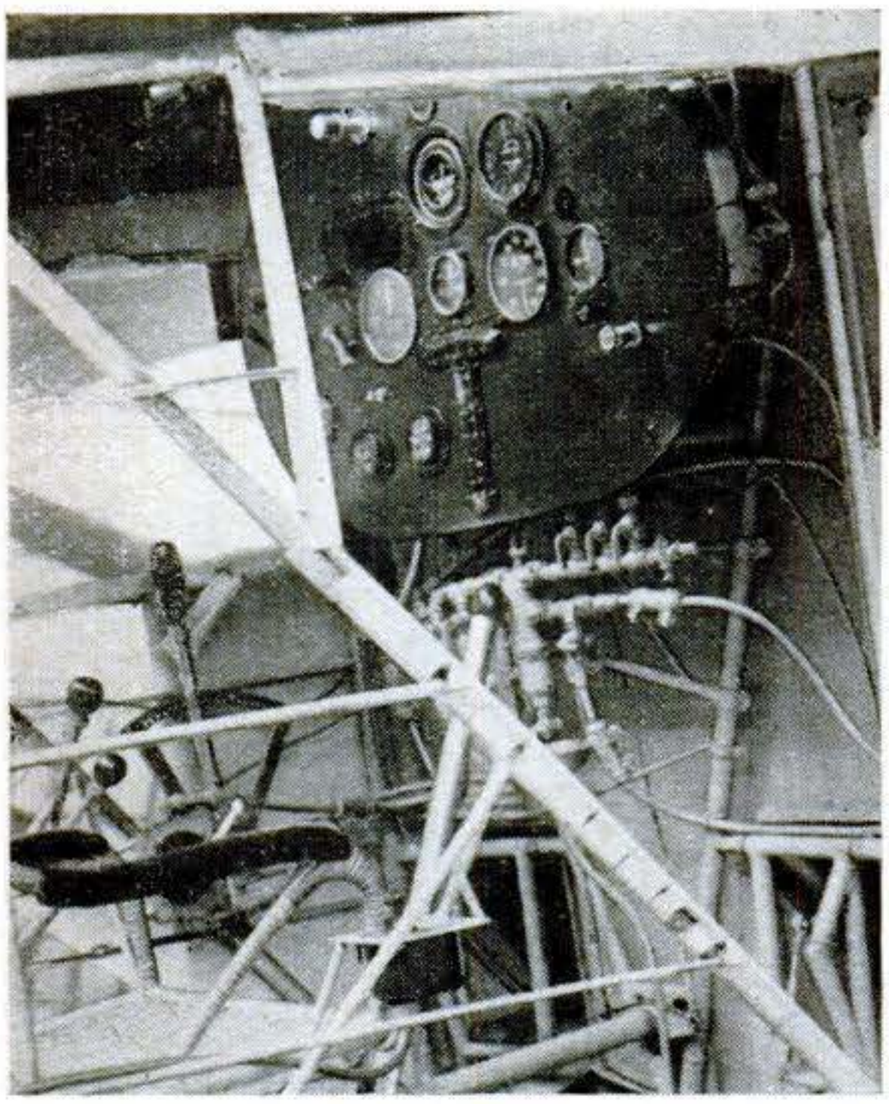
The cockpit: essentials only



Sitting in his wicker chair, he could reach the "plumbing": the fuel valves (center)

in Ryan's "factory"—it was an abandoned fish cannery—with the little firm's only engineer, 27-year-old Donald Hall: efficiency first, safety second, and comfort last. Two and a half months later, he saw his design ideas pay off handsomely on the plane's first real test, the flight on May 10 from San Diego to Lambert Field, St. Louis. It took him 14 hours, 25 minutes. No man had ever traveled so fast from the Pacific coast.

On May 12, he set another record by flying from St. Louis to Curtiss Field, Long Island, N.Y., in seven hours, 20 minutes.

Then, on May 20, he took off for Paris. Exactly 33 hours, 30 minutes, 29.8 seconds later he touched down at Le Bourget Aerodrome. He could have gone on to Rome—in fact he had toyed with the idea as he approached Le Bourget.

Like most airplanes, the Spirit of St. Louis grew out of an earlier design, the Ryan M-2, but it was strictly one-of-a-kind. It was designed in 850 hours—almost completely by Donald Hall—to do one thing: fly from New York to Paris. And with the exception of good-will tours of Europe and North and South America, that was all it was ever used for. It was shipped back to the States on the U.S. cruiser Memphis, and now hangs in the Smithsonian Institution.

From the beginning, everything was sacrificed for range; of her 5,250-pound gross weight, the Spirit of St. Louis carried 2,750 pounds in fuel, well over half her weight.

Fuselage is towed to test site

Big fuel tank forward of cockpit shut off view. To land and take off, Lindbergh peered out the side window

The huge 209-gallon main fuel tank almost filled the cockpit, completely cutting off all forward vision. To land and take off, Lindbergh looked out to the side. Once or twice he used the periscope that had been designed for him by a former submarine captain.

To keep him on course an earth inductor compass gave him his position in relation to the earth's magnetic lines of force. A wind-driven generator helped operate this.

The most unusual feature of the plane, however, was its streamlining. The fuselage curved from spinner to tail in an unbroken line. All struts were faired with balsa, then covered with sheet aluminum. The shock absorbers were streamlined. Even the wheels were covered with a doped

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fabric. The gap between fin and rudder was sealed with a strip of fabric. And the engine cowling was faired into the fuselage.

The result of this unheard-of streamlining was a maximum speed 10 m.p.h. higher than that of the M-2—even though the Spirit of St. Louis weighed twice as much. And the range of this tiny 223-hp. plane at practical cruising speeds, fully loaded, was 4,040 miles!

Hall used M-2 tail surfaces even though he knew they were too small. It saved design time. And it made the plane purposely unstable—which pleased Lindbergh because he knew it would keep him awake during his 40-hour grind.

For added safety, in case of a crash, Lindbergh insisted that the fuel and oil tanks be placed forward of the cockpit. He had heard of too many crashes in which the fuel tanks had torn loose and come crashing down on the pilot.

Famous plane ends its flying days

With Col. Lindbergh at the controls, the Spirit of St. Louis lands at Bolling Field, Wash., May 2, 1928. This was its final flight, before going to the Smithsonian Institution

The Spirit of St. Louis had one of the first cross-feed fuel systems ever developed. Two independent fuel lines ran from the cockpit distribution system to the engine. If the engine pump in either of them failed, fuel could be hand wobble-pumped from either fuselage tank to the wing tank where it could then flow to the engine by gravity.

The landing gear had the unusually wide spread of 10 feet when fully deflected. The struts were fabricated of chrome molybdenum (SAE 4130) steel tubes and heat-treated.

Trim tabs were unknown in 1927, but the Spirit of St. Louis had an adjustable stabilizer and fin.

In the 46-foot spruce-and-plywood wing, the ribs were spaced 11 inches apart instead of the usual 15 inches to maintain an accurate airfoil contour.

Unbelievably, this advanced airplane was built by 19 men and women in only 62 days. END

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Is Your Youngster a Budding Scientist or Engineer?

Here's a wide-open field with an unlimited future. Should you help your child aim for it? Read what the experts say.

By Wesley S. Griswold

ALL this spring "ivory hunters" from the nation's industries and laboratories have been besieging U.S. college campuses. They are employment officers, scrambling to hire engineers and scientists, class of '57. At the end of World War II about 800 firms were trying active college recruiting; this year nearly 5,000 companies are doing it.

So fierce is the competition for these baby engineers that starting salaries have averaged $400 a month. Especially promising youngsters may be offered more than $600 a month, and they can take their pick of a dozen jobs. Extra inducements for accepting employment with one firm include an $800 bonus, an expense account and an automobile for unrestricted use.

This talent hunt is not just in colleges. Government agencies and industry are constantly rummaging through the ranks of the already employed, trying to grab scientists and engineers from each other.

Will your youngster find employers hotly bidding for his services when he is ready to go to work? Probably, if he has what it takes to become a first-rate scientist or engineer.

Educated guess. Is either of these closely related professions the lifework for your youngster? If he is much under college age, you can't *know*. But you can make an educated guess: 1) by comparing him to others who have grown up to success in these professions, and 2) by making wise use of guidance experts who can evaluate his abilities through tests.

What characteristics typify the scientist-to-be? Experts have long been trying to find out. Some new findings, soon to be published by Drs. Donald E. Super and Paul B. Bachrach of Columbia University, paint this picture of a budding scientist (the profile of a budding engineer is virtually identical):

- Science and mathematics attract him

What Distinguishes a Scientist from an Engineer?

One of the best explanations comes from the Engineers' Council for Professional Development:

"The scientist is ever concerned with expanding man's knowledge of nature's laws. The engineer is charged with the application of these [laws] to benefit mankind. Both are dealing with the same laws of nature: mathematics, physics and chemistry. Both must have clear, analytical minds, and both must have . . . proficiency in language."

PHOTO BY HUBERT LUCKETT

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young. Between his tenth and fourteenth years, they have begun to predominate over other interests. His hobbies have assumed a scientific slant—collections, photography, chemistry experiments, electronics.

- He feels somewhat isolated from other children but doesn't mind this much. He may be "poorly adjusted" socially, though he is often self-confident. He has a strong urge to excel.
- He reads a lot, has a large vocabulary, speaks well and forcefully.
- He is ingenious, energetic and original. He is a "self-starter" and generally finishes what he starts.
- He is curious about how things work and often is clever with his hands. He can look at something and imagine how it would appear from a different angle. (Experts call it "good spatial visualization.")
- He is good at mathematics, with a high analytical ability, and is often a superior student in other ways.

Testing in school. The profile above is at best a general guide—many children answering to such a description have grown up to successful careers far removed from science or engineering. Here the new science of psychological testing can help you. In many schools today youngsters routinely take written tests that reveal mental ability, scholastic achievement (that is, what the youngster has *done* with his mental ability) and general aptitudes. By high school, a boy's or girl's test scores and academic records begin to give a broad picture of the youngster's capacities.

In an increasing number of U.S. high schools, these records and scores are supplemented by a whole battery of new tests, usually given at the tenth grade. These measure such things as verbal reasoning ability, numerical ability, abstract reasoning ability, and mechanical comprehension.

How good are these tests? The ones given in high schools cannot sort out children for specific vocations, but can and do reveal inclinations toward an interest in science.

A far more comprehensive—and tougher—test has shown striking accuracy. This is the Annual Science Talent Search, conducted by Science Clubs of America to locate promising teen-agers and reward them with scholarships. It has operated since 1942 (and shelled out $165,000 in scholarship money).

In 15 years, 600 youngsters were

Portrait of a budding scientist

THE absorbed, intelligent-looking 12-year-old whose picture appears on page 60 is not a professional model. He is a boy who seems destined to be a scientist. His name is Frank A. Leachman Jr., and he lives in Bristol, Conn. POPULAR SCIENCE became acquainted with Frankie when he submitted a how-to-make-it article to us about an ingenious scientific device he designed and built himself.

In the photo here, Frankie is using his creation to set fire to a piece of paper by focusing the sun's rays on it. Most of us have done this at one time or another with a magnifying glass. But Frankie is doing it with a small solar furnace. To see how he built it, turn to page 178.

Frankie, an only child, is now in the seventh grade. Since he entered the fifth, he has had an enormous appetite for reading. He devours books on scientific subjects and on the lives of famous scientists. He has built a one-tube radio. He is now construct-

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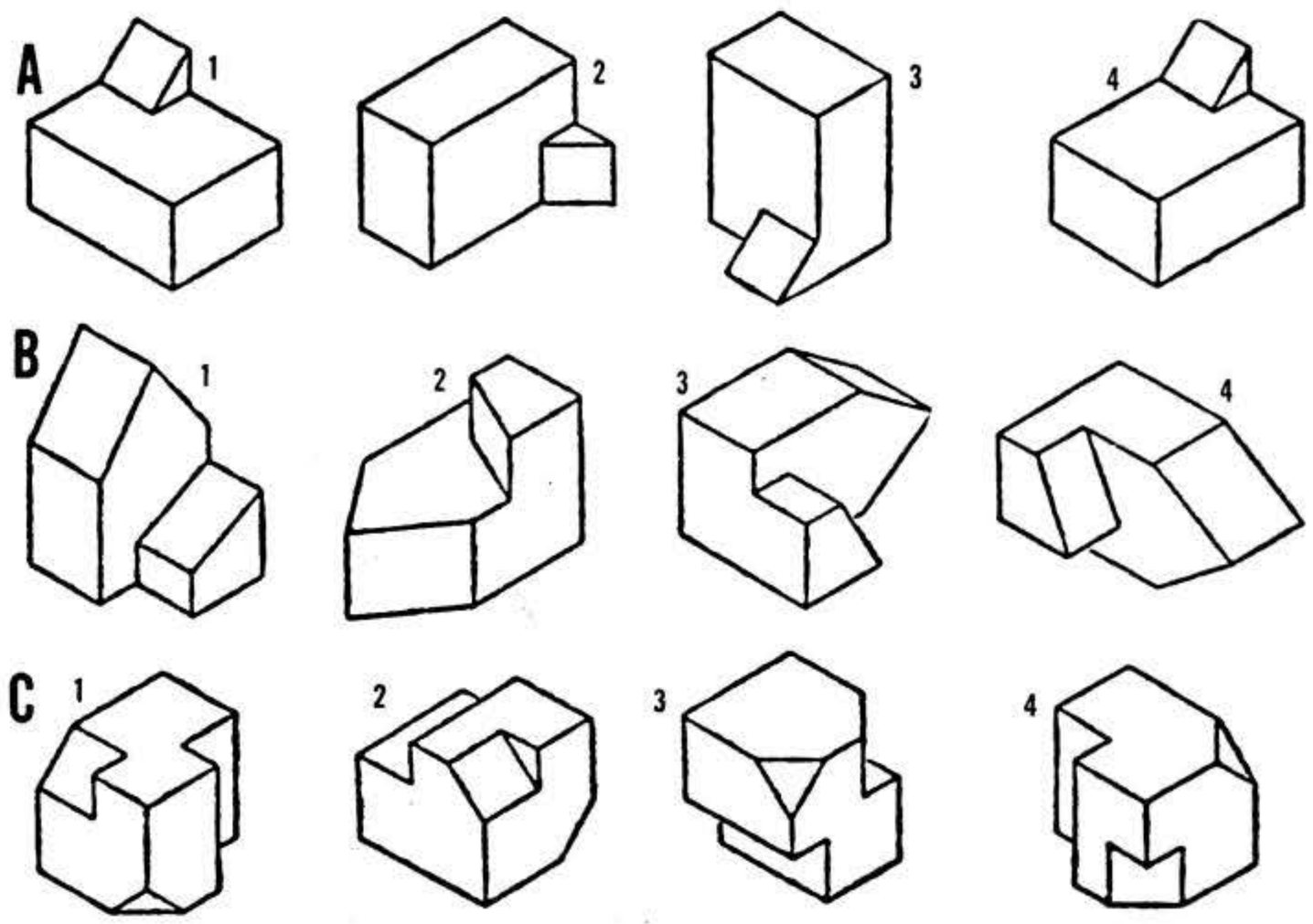
SCIENTISTS AND ENGINEERS, especially the latter, usually score high in this kind of test,* which is designed to determine how good a person is at "spatial visualization." This is not a complete test, but it is typical of one.

In each row of drawings, two—and only two—are different views of the same object. Get your youngster to mark the drawings that he thinks are two views of a single object. The correct answers are on page 252.



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chosen. Ninety-three percent of them are now trained scientists and engineers—and none is more than 34 years old. Almost every one has earned an undergraduate college degree. About half of those now old enough to be eligible for doctors' degrees (Ph.D., Sc.D., M.D.) have them, too.

These young people are exceptional, of course—unusually bright and long interested in science. But the success of the tests in correctly predicting their achievements does point up what you can expect from the right testing for your child.

Professional advice. Most U.S. high schools now try to help students chart their futures. The best high-school guidance counselors don't tell a student what career he should aim for. But they do try to help him decide for himself—along paths suggested by his test scores. They also welcome parents to guidance conferences, because this can help resolve conflicts between the desires of a youngster and his parents.

[Continued on page 250]

ing a Geiger counter. In the past few years, he has acquired a chemistry set, a microscope and an "atomic-energy" kit.

From the time Frankie was old enough to put sentences together, he has been asking questions about what things are made of and what makes things go. His parents have usually managed to supply the answers. If they didn't already know them, they helped him find them at the library.

Now, Frankie's mother says, he usually finds his own answers, in books or "by taking anything and everything apart and putting it together again."

Because of his avid reading, his vocabulary is unusually large, and he not only knows the meanings of the adult words he casually uses but how to spell them.

Yet Frankie is no bookworm. A friendly youngster, sturdy and healthy, he loves to swim and play basketball. His grades in school are good.

The Leachmans have been both fascinated and puzzled by the interests and capabilities that Frankie is developing as he grows. They haven't known exactly what these characteristics meant or what they should do about them.

The accompanying article is one of a series that POPULAR SCIENCE is publishing in the hope of helping the Leachmans and all other parents guide their children toward careers suited to their tastes and talents. Previous articles have contained expert advice on how to be a good father to a gifted child and how to help your youngster get into college.

NEXT MONTH: What if your child can't go to college? About 65 percent of American youngsters do not. This need not discourage you or your child. Opportunities for fine careers—without a degree—are growing every year. The June issue of Popular Science will tell you what they are and how you can make the most of them for your children.

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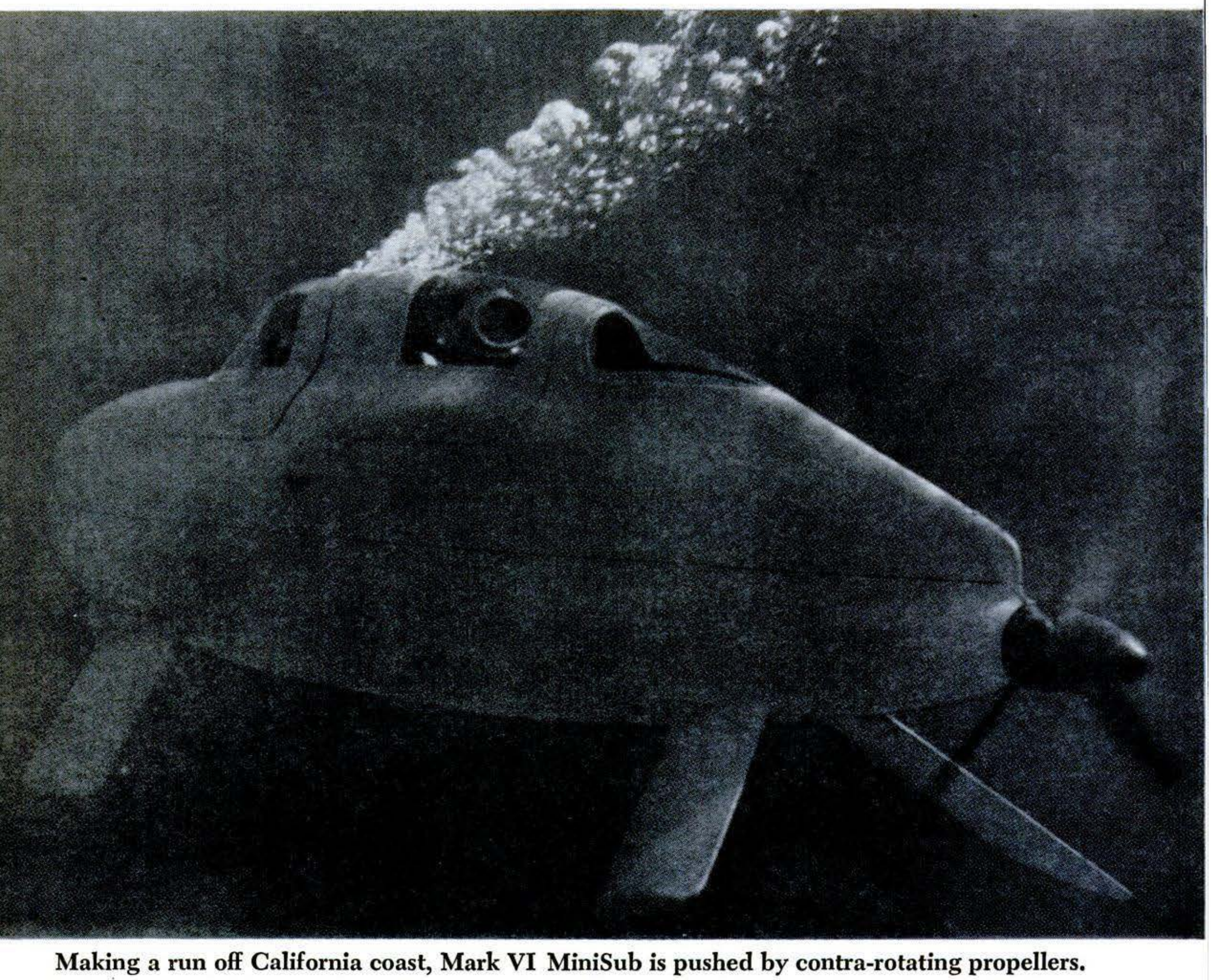
Tiny Sub Maneuvers Under Water Like a Plane

By Jerry Hulse



Making a run off California coast, Mark VI MiniSub is pushed by contra-rotating propellers.

IN THE event of another war, Navy underwater demolition teams may execute their deadly missions in an extraordinary little craft that performs under water like an airplane in the sky.

The MiniSub is a miniature, two-man submarine that can loop, roll, climb and dive. One model, the Mark VI, looks like a scaled-down version of a jet fighter. The stubby, swept-back fins on the sleek fuselage resemble wings and tail, and the crew peers out of a Plexiglas canopy. (The fins are swept back to shed seaweed, which has brought death to more than one frogman.)

Inside the Mark VI, the crew either

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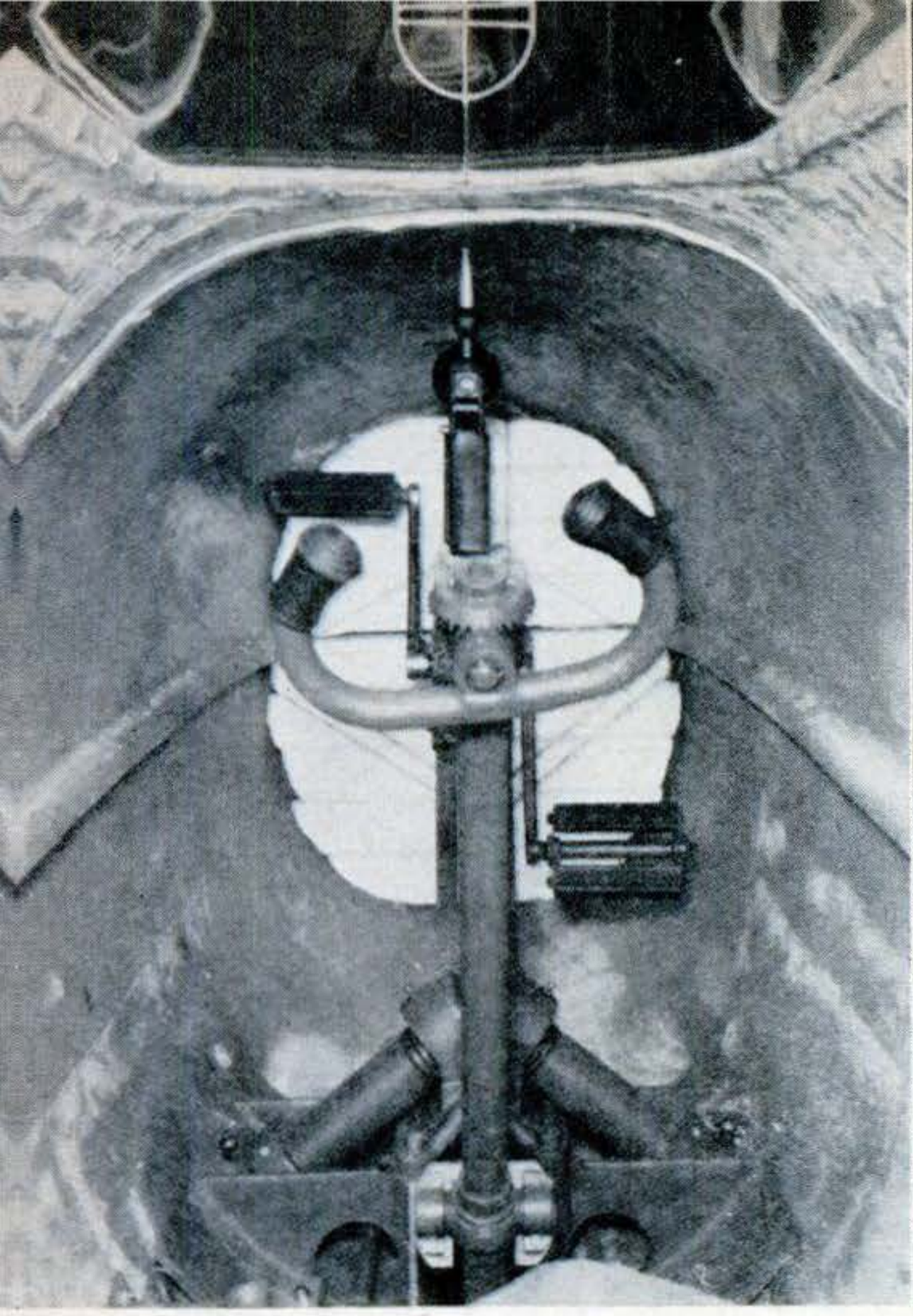
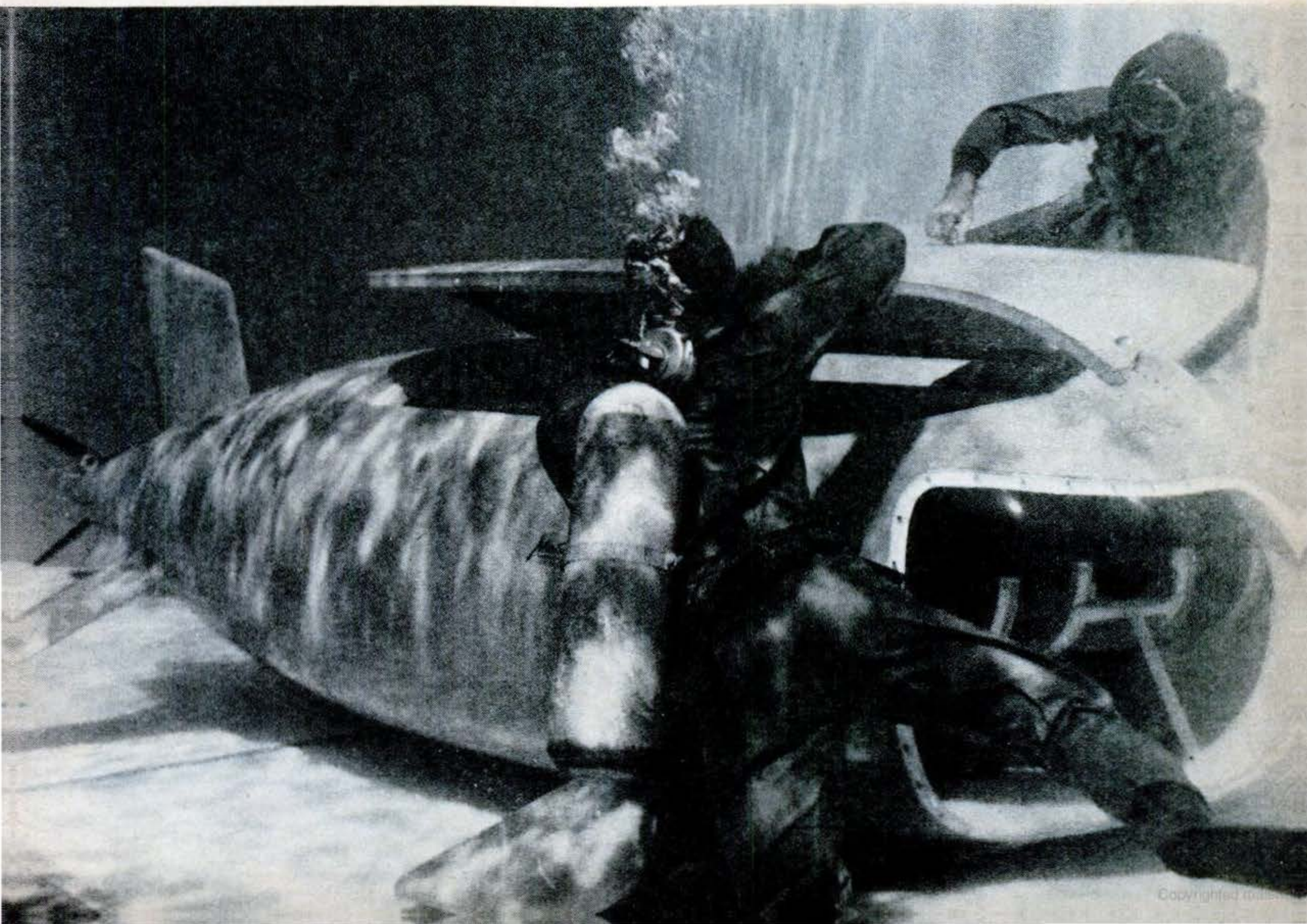


SIMPLE CONTROL STICK and bicycle-type pedals are located in front of the forward seat in the MiniSub.

PILOT DROPS INTO MINISUB in test tank. Built of fiberglass, the Mark VI weighs 450 pounds, is 14 feet four inches long, carries two men, 300 pounds of equipment.

Pilots test hinges of bigger Mark VII's hatches. In a jam, survival may depend on fast escape.



sits back-to-back or faces in the same direction. The sub is steered with a control stick connected to four fins—two forward and two aft. To dive, the pilot merely pushes the stick forward. To climb, he pulls back. Right and left turns are made by pushing the stick in the desired direction. To roll, the stick is twisted.

POWER is supplied either by foot pedals connected to propeller blades at the rear, or by a one-hp., battery-powered electric motor. The manufacturer, Aerojet General Corp., of Azusa, Calif., claims that the MiniSub can be pedal-pumped for long periods of time at nearly four m.p.h. with no more effort than riding a bicycle on level highway. By using the motor, the MiniSub can speed up to about 7½ m.p.h. Most frogmen prefer pedaling, for it helps keep them warm in frigid waters.

Because MiniSub is free-flooded, the two-man crews must wear breathing tanks. But they can stay down much longer than their brother frogmen for, once inside, they disconnect the breathing lines from the portable lungs on their backs and plug into air bottles.

Its practicality makes the MiniSub a good bet to become standard equipment for Navy Underwater Demolition Teams. In his new book about Navy frogmen, *The Naked Warriors*, Cmdr. Francis Douglas Fane calls the MiniSub "one of the most remarkable of all recent developments in . . . underwater conquest."

Fane is chief of the UDT Unit (Pacific Area) attached to the Amphibious Force, Pacific Fleet. He supervised the testing of the MiniSub at the great Navy UDT base at Coronado, Calif. It was Fane, according to Aerojet officials, who encouraged the MiniSub's development during its early stages.

"The MiniSub," Fane says, "would extend our range of operation, and enable us to reach our objective without fatigue."

How far could a frogman travel in a MiniSub? "It all depends on how long a man can remain submerged—endure the cold, that is," Fane explains.

Not only would the MiniSub increase the speed and range of frogman attacks, but its use in certain instances would require fewer men. In World War II, a dozen men, struggling through rough seas with explosives, wrenches and other equipment, might have been needed to sink a destroyer. With the MiniSub, two men could handle such a mission.

Arriving at their destination, the operators would land the MiniSub on the ocean floor, fill the ballast tank with water to keep the sub from surfacing, and tether the craft to underwater growth to prevent drifting with the tide.

Mission completed, they would blow the water from the ballast tank with high-pressure air from another container, and pedal away. Silent pedal power would lessen the risk of detection.

TO MAKE life easier for frogmen, Aerojet has developed, in addition to the Mark VI, the more spacious Mark VII. In the new model, the crew lies prone—able to turn from side to side—and peer out through two forward windows resembling the bulging eyes of a sea monster. While capable of all the maneuvers of the VI, Mark VII looks like a shark rather than an airplane. It, too, can be pedal- or motor-driven. In addition to side fins, the VII has a dorsal fin to provide directional stability and better control in turns. This was necessary because its flatter hull made maneuvering somewhat sluggish.

"A ride in either model is a bit spooky at first," says Harold Osborn, who was chief test pilot until his transfer to Washington, D. C., as an Aerojet sales representative. "Once, off Catalina Island, I put a MiniSub into a straight climb and ended up right under one of those glass-

[Continued on page 254]

NEXT MONTH: A fire-eating missile that's drawn to its aerial prey by exhaust flame—that's the Sidewinder. Read: "The Missile That Strikes like a Rattlesnake" in June PS.

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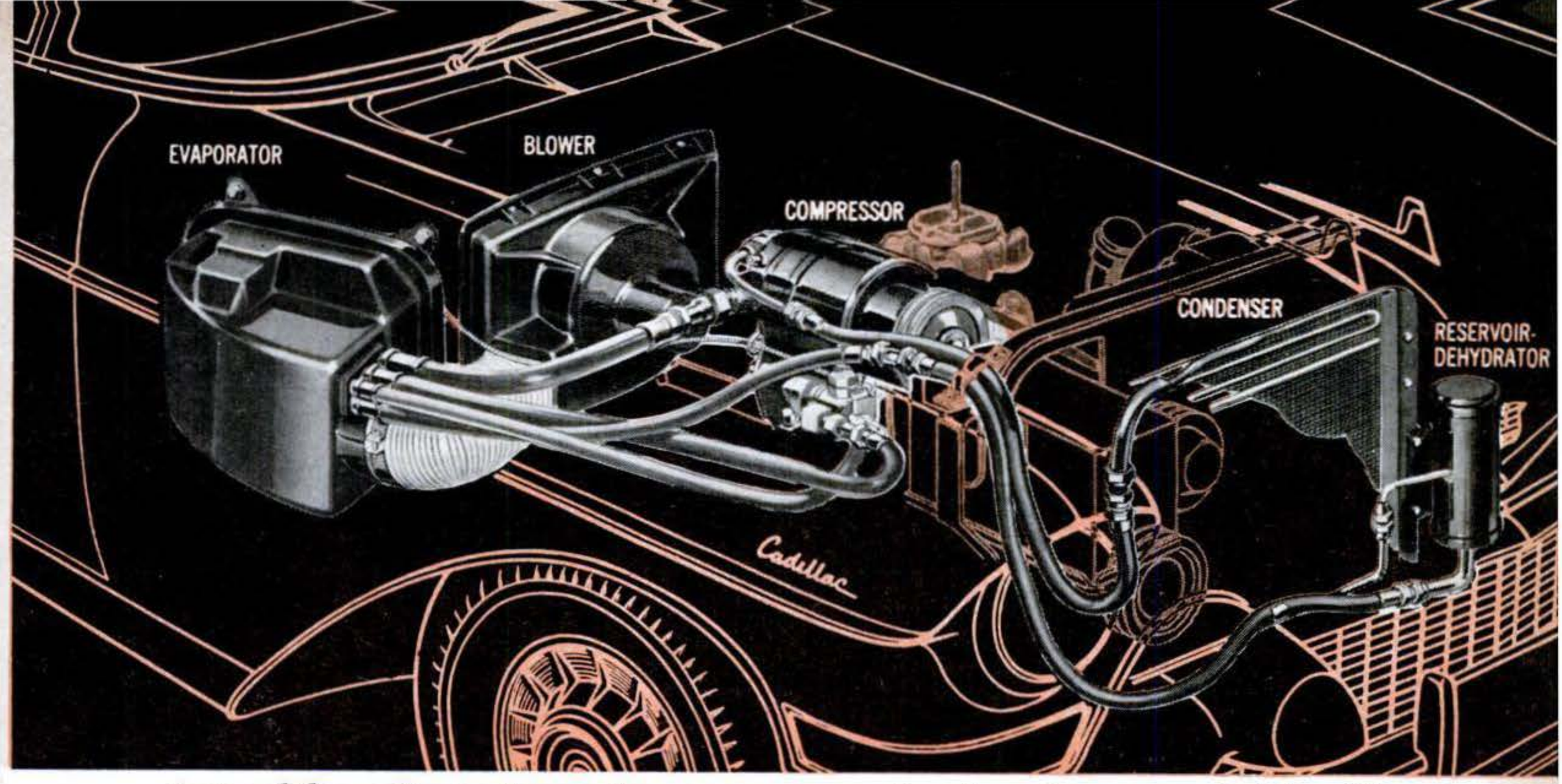


Automobile cooling units use the same components—plus a fan—as an electric refrigerator.

What's New in Car Air Conditioners

How good are they? Can I get one for an older car? What will it cost me—in dollars and horsepower?

By Devon Francis

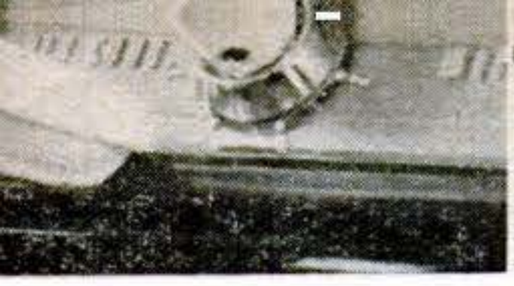
THIS year, more than ever, you can motor in cool comfort. Automobile air conditioning suddenly has hit a boom. Prices are down. They're going still lower.

In the seven years since Detroit stopped flirting with car refrigeration and decided to go steady, the results have been salubrious:

- Good cooling units can be bought for as little as $340, including the cost of installation. (Some sold, only four years ago, for $600 to $700.)
- Many are transferable from one car to another.
- More units are featuring full, fresh-air circulation after initial "cool-down" with recirculated air.
- Units can be purchased for most brands of cars as much as eight years old.
- Many factory-installed units combine the heater and air conditioner at a single "package" price.

There are about a half-million air conditioners on the road today. While the sales of automobiles were skidding last year, air conditioners were selling like corn at a clambake. As against 40,000 conditioners bought in 1953, a quarter of

UNITS CAN BE INSTALLED on current cars after they leave the factory, and on older cars, too. This "hang-on" is made by Chrysler Corp.



LINCOLN

CADILLAC

MERCURY

OLDSMOBILE

Combination controls now let the motorist create his own weather,

a million were installed in 1956. The factories are talking of selling a half-million in 1957, and 2,500,000 *a year* by 1960. If the trend keeps up, not having an air conditioner may hurt at trade-in time, as not having an automatic transmission does now.

Car air conditioners come in two varieties—those that are factory-installed on new cars, and those that are installed by a garage or car dealer *after* the purchase of a car. The latter are called "hang-ons."

AUTO NEWS FOR NEXT MONTH

All About Foreign Cars: *What's it like to live with one of those foreign cars with a vest-pocket engine—a Volkswagen, Renault or Saab? Devon Francis tells of the joys and tribulations in June PS.*

Attention Ford Owners: *Here's what you want to know about home maintenance of the '57 Ford. A six-page article written to be read, saved—and applied—will give you solid, shop-manual information. (Similar articles for Chevrolet and Plymouth owners will appear in later issues.)*

Hang-ons themselves are of two breeds—those that are made for the automobile companies for dealer installation, and those made by independent manufacturers for sale through outlets other than, or in addition to, car dealers. These two are blood brothers.

Frigidaire and Harrison Radiator make components for factory-installed and hang-on systems in General Motors cars, Airtemp for those in Chrysler Corp. cars. American Motors gets its conditioners from its Kelvinator division, Ford Motor and Studebaker-Packard from independents.

The varieties do differ. Factory-installed units circulate fresh, or mostly fresh, air in a car. The evaporator, the cooling part of the system, is out of the way: on the engine side of the firewall. The nozzle arrangements for air distribution by a fan, or blower, are more flexible and designed for draftless cooling.

Hang-ons use some, or all, of the air for recirculation. It's refreshed in part by leakage through crevices in the car body. The evaporator takes space in the passenger compartment under the instrument panel. The air distribution is not as well controlled.

With yesteryear's car, however, the motorist has no alternative to buying a hang-on. Moreover, the only people who presently make a unit for him are the independent manufacturers. The automobile companies have not been in the air-conditioner business long enough to build up a stockpile of brackets and fittings for anything but current vehicles.

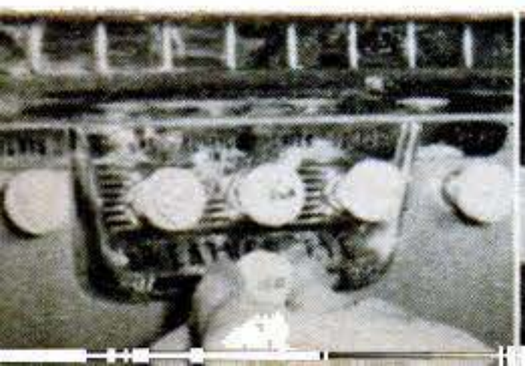
Air-conditioner designs have changed. As late as last year, the evaporator on many air conditioners was put in the car trunk, hard against the baby's folding perambulator and the vacation bags. Scoops, or "ears," projected from the sheet metal on the car's flanks to catch air for the evaporator. Plastic ducting spewed the cooled air to the passengers.

Now, with a single exception, the factory-installed units on the market are all of the front-end kind introduced by Pontiac in 1954. Plumbing no longer writhes the length of the car, like that in a split-level ranch house in Suburbia. The exception is the unit for the big limousines, which still has the evaporator in the trunk to cool the dowager in the back seat.

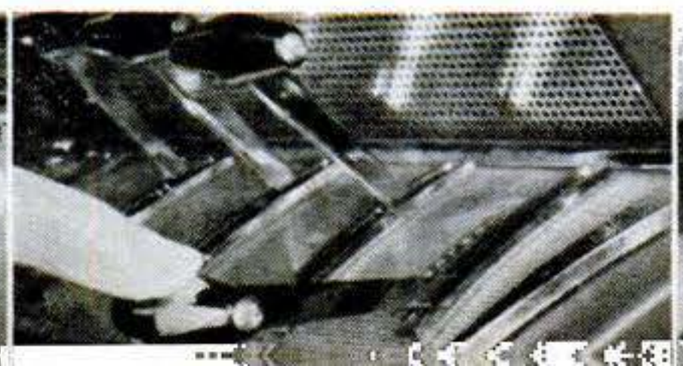
Front-end hang-on units have made it possible to air-condition convertibles and station wagons.

Car air conditioners are rated on capacity. One index to capacity is "ton-

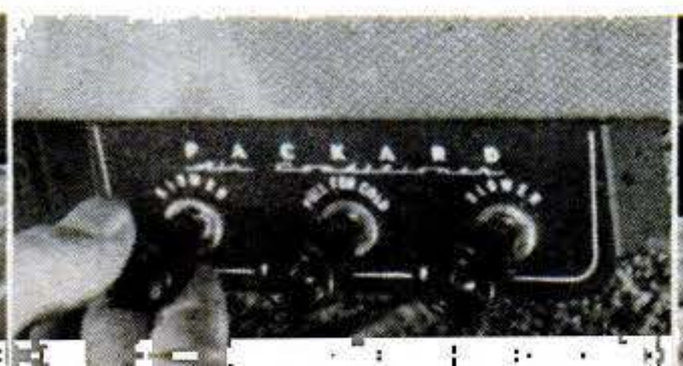
RAMBLER



CONTINENTAL MARK II



STUDEBAKER-PACKARD



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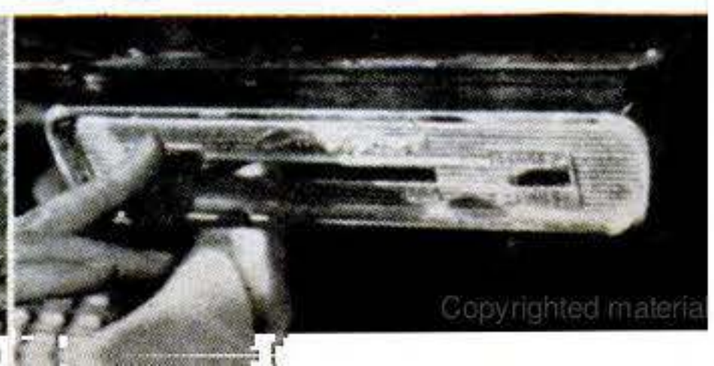

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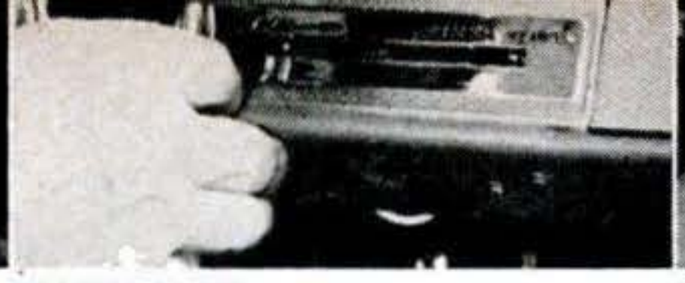
FORD

CHEVROLET



PLYMOUTH

CHRYSLER

summer as well as winter

nage." This is the heat absorption (and thus cooling effect) of one ton of ice melting in 24 hours. Another index is "CFM"—cubic feet per minute—the air circulation capacity of the blower.

What's the cost of operating a car air conditioner? Testimony is available only from the manufacturers themselves. They say that it costs about a mile-per-gallon loss in gas economy, or less. At maximum capacity, some six or seven horsepower, or two to three percent, is drained from the engine output. After an initial "cool-down" period, this drops to perhaps four horsepower.

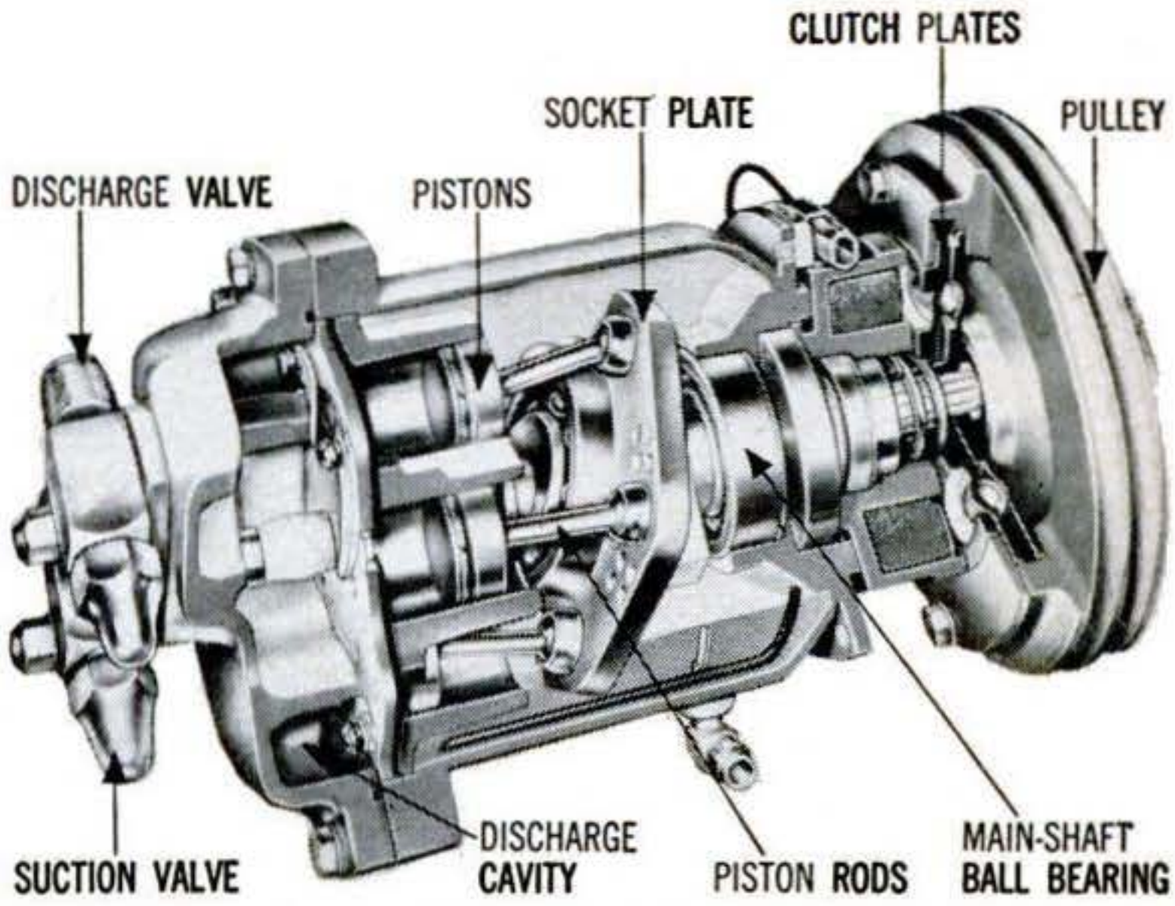
At today's burgeoning power outputs, it would take precision instruments to measure a deterioration in car performance with a conditioner up front.

There *are* debits. Conditioners impose from 100 to 160 extra pounds on the front wheels. The added steering effort required is small but noticeable, and the buyer of a new car with refrigeration will be smart to order power steering, too, if his wife is waspish about parking sweats.

A weight imbalance is set up between the bow and stern of the car that is evident on ice or snow, and the braking effort between the front and rear wheels no longer is mated. The generator is taxed. Engines can overheat at idle, and the addition of a manual or automatic idle-speedup is desirable.

Compensation for some of these troubles is made when conditioners are installed at the factory.

To the motorist who wants relief from the heat, all these things are minor. The fringe benefits of air conditioning are manifold. Closed windows keep out dust. The air is dried. Some units have air filters, and even those that don't have them exert a filtering effect in the evap-



COMPRESSOR IS THE HEART of an air conditioner. This one, by GM, uses wobble plate to drive pistons to pressurize Freon gas. Cooled in condenser, it becomes liquid. Released from pressure, it boils, absorbing the car's heat.

ASSEMBLY-LINE INSTALLATION of air conditioners is routine this year for the first time. Here a workman is getting ready to close cooling circuit on a Plymouth with Freon charge. Suction pump has drained plumbing of moisture.

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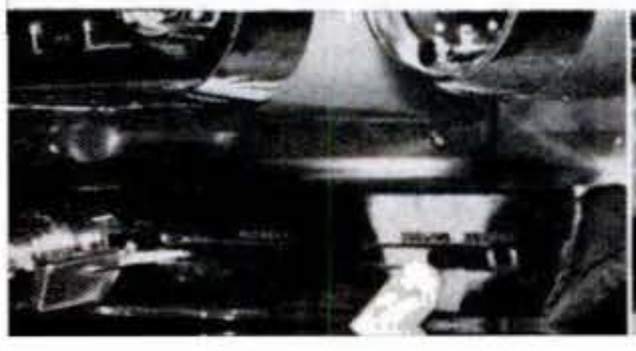
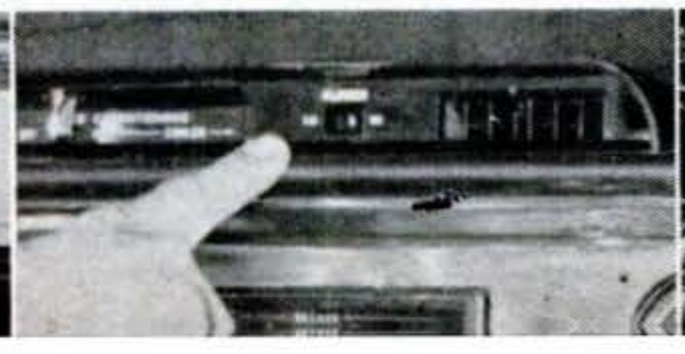
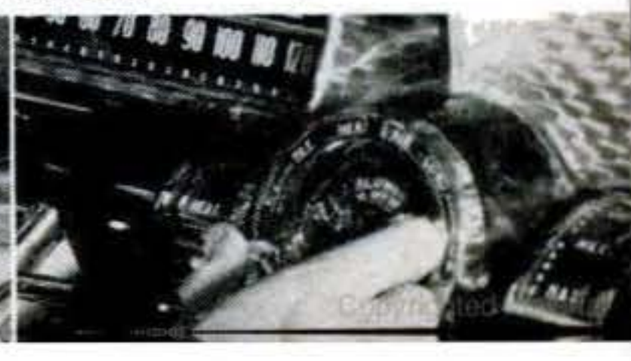


NASH-HUDSON

PONTIAC



BUICK



How to buy a car air conditioner

If you are getting a new car and wish air conditioning, order it when you order the car, for factory installation. The unit will be tailored specifically for your car, and may save paying extra for a heater. Many modifications of the car for air conditioning are possible there that are not practical later.

If you want your present car air-conditioned, or if you contemplate transferring the unit to a future car, shop for a "hang-on" unit. Remember to ask about installation charge when comparing costs. While cooling capacity is important, these features are usually desirable as well:

- **A compressor clutch responding to the on-off switch.**
- **Automatic freeze protection for the evaporator.**
- **Automatic or manual speed-up of the engine's idling rate.**

orator. The factories get testimonial letters from rose- and hay-fever sufferers. The fatiguing air-buffeting at high speeds with windows open disappears.

"It's astonishing how restful it is to drive with the windows closed," reported one refrigeration engineer.

Nor is that all. Driving noises shrink. Radio volume and voice levels can be kept normal. No longer do a motorist and his passengers have to sweat through a rainstorm. And some air-conditioning-heating systems are so versatile that they can pour warmth on a wife's cold feet while they cool her mate's beaded brow.

The car air conditioner no longer is indigenous only to Texas, or indeed to states south of the Mason-Dixon line.

As one Ford refrigeration engineer put it, "We've stopped thinking in terms of Texas summers. In Chattanooga in March, at 50 degrees, and in Sault Ste. Marie in May, at 45 degrees, a car needs cooling with the windows closed under a full 'sun load.'"

The appeal of air conditioning is insidious. Boarding a cool car on a hot day is like scratching a persistent itch. The refrigeration people are catering to one of the most primitive of human responses —relief from discomfort.

Their work is paying off. Within a city block or two after an air conditioner is switched on, the driver and his passengers begin to feel "cool." They aren't actually cool. They are only experiencing the disparity between the "ambient"—outside—temperature and that inside the car, abetted by the cooling evaporation of their perspiration in drier air.

I myself learned this in a place appropriately named Hell, on the Cali-

[Continued on page 258]

BUYER'S GUIDE TO CAR AIR CONDITIONING...Factory Installations

MANUFACTURER	IS UNIT INTEGRAL WITH HEATER?	FACTORY-RECOMMENDED RETAIL PRICE	CAPACITY (tons)	BLOWER CAPACITY (cu. ft. per minute)	COOL-DOWN TIME[a] (minutes)	IS TEMPERATURE THERMOSTATICALLY CONTROLLED?	AIR RECIRCULATED[b] (percent)	IS FREEZE PROTECTION PROVIDED?	IS THERE PROVISION FOR ENGINE-IDLE SPEEDUP?	WEIGHT OF UNIT (pounds)	IS A HANG-ON UNIT AVAILABLE?
AMERICAN MOTORS											
Hudson	yes	$415	1½	150	n.s.	no	70	yes	no	120	yes[c]
Nash	yes	$415	1½	150	n.s.	no	70	yes	no	120	yes[c]
Rambler	yes	$362	1½	150	n.s.	no	70	yes	no	94-100	yes[c]
CHRYSLER CORP.											
Chrysler	yes	$506	1¼	220	15	yes	0	yes	yes[d]	120	yes
DeSoto	yes	$493	1¼	220	15	yes	0	yes	no	120	yes
Dodge	yes	$459	1¼	220	15	yes	0	yes	no	120	yes
Imperial	yes	$590	1¼	220	15	yes	0	yes	yes[d]	120	yes
Plymouth	yes	$445	1¼	220	15	yes	0	yes	no	120	yes
FORD MOTOR CO.											
Continental	no	$740	1¼	240	30	yes	90	no	yes	n.s.	n.s.
Ford	yes	n.s.	n.s.	242	n.s.	yes	0	yes	yes	166	yes
Lincoln	no	$475	1¼	240	30	yes	90	yes	yes[e]	n.s.	yes
Mercury	yes	$430	n.s.	275	n.s.	yes	85	yes	no	190	yes
GENERAL MOTORS CORP.											
Buick	yes	$430	n.s.	n.s.	n.s.	no	75	yes	no	125	yes
Cadillac	no	$474	n.s.	n.s.	n.s.	yes	0	yes	yes	135	yes
Chevrolet	no	$430	n.s.	n.s.	n.s.	yes	0	yes	yes	125	yes
Oldsmobile	no	$432	n.s.	n.s.	n.s.	no	0	yes	no	125	yes
Pontiac	no	$430	n.s.	n.s.	n.s.	yes	0	yes	no	125	yes
STUDEBAKER-PACKARD											
Clipper	no	$440	1½	300	n.s.	no	n.s.	yes	no	133	no
Studebaker		$395									

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BUYER'S GUIDE TO CAR AIR CONDITIONING . . . Hang-on Units

MANUFACTURER	BRAND NAME	FACTORY-RECOMMENDED RETAIL PRICE	CAPACITY (tons)	BLOWER CAPACITY (cu. ft. per minute)	COOL-DOWN TIME[a] (minutes)	IS TEMPERATURE THERMOSTATICALLY CONTROLLED?	AIR RECIRCULATED[b] (percent)	IS FREEZE PROTECTION PROVIDED?	IS THERE PROVISION FOR ENGINE-IDLE SPEEDUP?	WEIGHT OF UNIT (pounds)	INSTALLATION CHARGE	INSTALLATION TIME (hours)	BRANDS AND MODEL YEARS OF CARS AVAILABLE FOR
A. R. A. MFG. CO.	Direct-Aire President	$349 $430	n.s. n.s.	350 400	n.s. n.s.	yes yes	100 100	yes yes	no no	90 136	$45 $45	4 4	1954-57, Buick, Chrysler, Ford, Mercury, Lincoln, Oldsmobile; 1950-57, Cadillac; 1955-57, Chevrolet, Dodge, Plymouth, Pontiac; 1953-57, DeSoto; 1951-56, Packard
ARCTIC AUTOMOTIVE	Arctic	$379[f] $489[fg] $565 up[fh]	2+ 4+ 4½	265 400 plus 500	n.s. n.s. 2	no no no	n.s. n.s. n.s.	yes yes yes	no no no	90 110 110	— — —	6 8 1½ days	1953-57, all cars except Nash and Hudson; units available for Thunderbird, Corvette, other sports cars
CAPITOL REFRIGERATION	Arctic-Kar Iceberg Husky	 $339[f] $399	 2¾ 3½	 240 580	 6-8 4-6	 yes yes	 100 90	 yes yes	 no no	 110 125	 — $70	 4 6	1949-57, any make or model
EATON MFG. CO.	Allstate	$299	2½	265	4-6	yes	100	yes	no	100	$45	4-5	1954-57, Chevrolet, Ford, Buick, Oldsmobile; 1954-56, Mercury, Cadillac; 1955-57, Pontiac, Plymouth
FRIGIKAR CORP.	Frigiking[l]	$288	2	397	6	yes	100	yes	no	n.s.	$50	4	1953-57, all cars, except those of American Motors and Studebaker-Packard
FRIGIQUIP CORP.	Frigette	$350	2	300	n.s.	yes	100	yes	no	100	n.s.	6[j]	1953-57, all cars, except those of American Motors and Studebaker-Packard
KECO INDUSTRIES	Keco	$366	1-3	n.s.	n.s.	no	100	yes	no	100	n.s.	n.s.	1955-57, Chrysler, DeSoto, Dodge, Plymouth 8, Cadillac, Oldsmobile, Chevrolet 8, Ford 8, Mercury
KLAUSS-JOYCE, INC.	Cool Queen	$325-350	2½	450	3	yes	n.s.	yes	yes	115	$12-15	4	1954-57, all GM and Chrysler Corp. cars; 1955-57, all other cars, except Nash
JOHN E. MITCHELL CO.	Mark IV	$300[k] $400[k]	3 3	302 320	2-3 2-3	n.s. n.s.	optional optional	yes yes	yes yes	n.s. n.s.	$40-60 $40-60	7[j] 7[j]	1954-57, all cars; 1950-57, some; Thunderbird units available
MOBIL-AIRE MFG. CO.	Mobilette	n.s.	3	400	10	n.s.	50	yes	no	103	n.s.	n.s.	1954-57, most GM cars; 1955-57, all GM, Chrysler Corp. and Ford Motor Co. cars, except Lincoln
NOVI EQUIPMENT CO.	Novi	$310[l]	3	320	3-5	no	100	yes	no	124	n.s.	n.s.	Front-end units: 1956, Ford, Mercury, Dodge, Plymouth, all GM cars except Cadillac; 1957, same except Dodge, Plymouth. Trunk units: 1956-57, all GM, Ford Motor and Chrysler Corp. cars
O. A. SUTTON CORP.	Vornado	$259-329	2-5	250	10-15	no	100	yes	no	120	$40	6[j]	1955-57, all except cars of American Motors and Studebaker-Packard Corp.

NOTES: All data listed is supplied by the manufacturers. Prices include Federal excise tax but no state or local taxes. Chrysler Corp. conditioners are transferable with modifications to same-make cars. Cool-down times vary widely because some manufacturers read the temperature only at "breath level," and some by averaging out readings at several points in the car.

n.s. Information not specified by manufacturer
[a] To reduce 100-degree interior temperature to 75 degrees in 100-degree outside heat, at 30 m.p.h. car speed
[b] At 25 m.p.h. after cool-down
[c] Also made for some previous American Motors models
[d] By fan speedup
[e] Accessory
[f] Including installation
[g] Trunk unit
[h] Overhead station-wagon unit
[i] Trunk unit available
[j] Man-hours
[k] Dash unit
[l] $340 with compressor clutch

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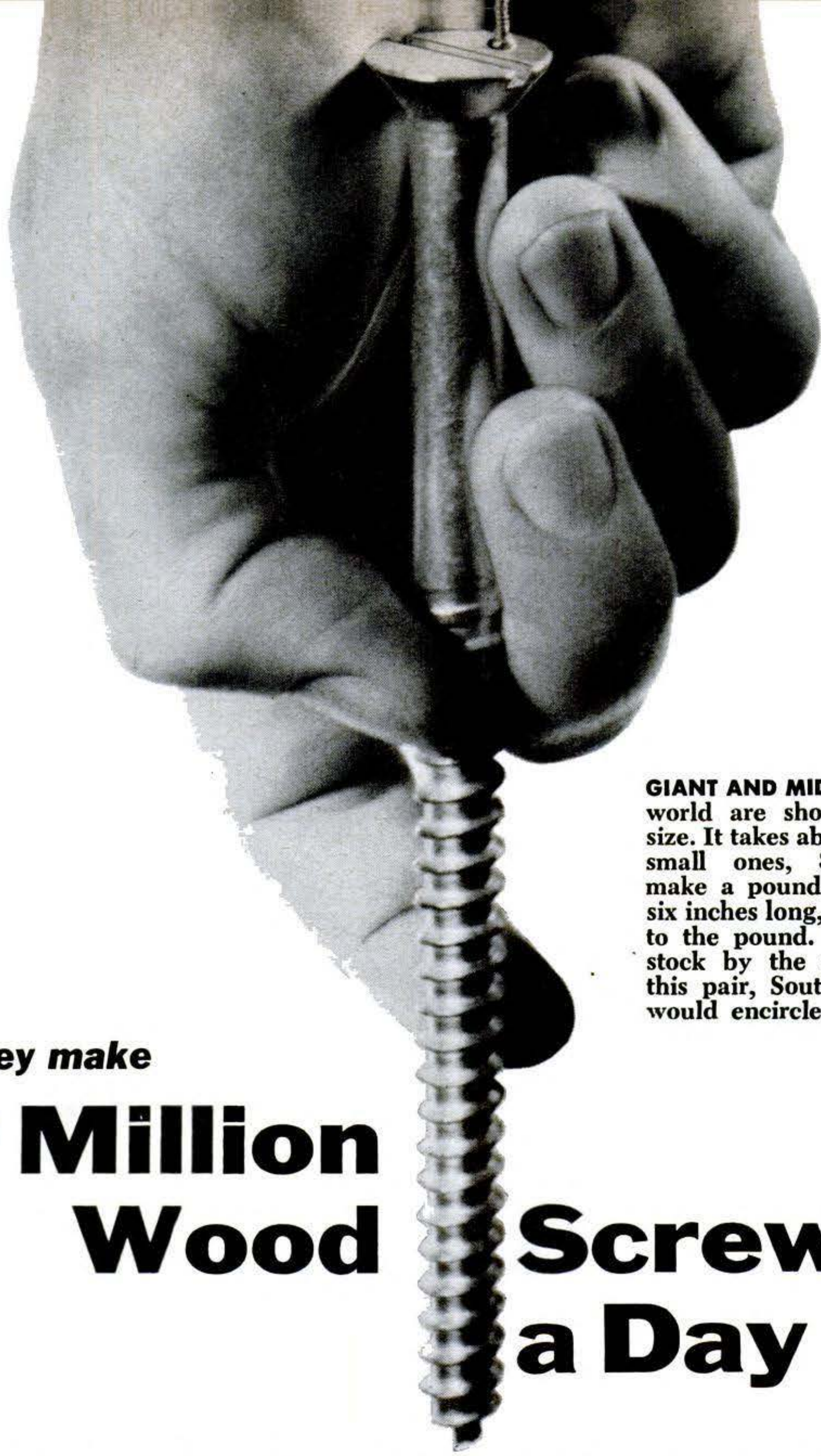

GIANT AND MIDGET of the screw world are shown here, actual size. It takes about 10,000 of the small ones, 3/16-inchers, to make a pound. The large one, six inches long, weighs in at five to the pound. Wire carried in stock by the manufacturer of this pair, Southern Screw Co., would encircle the earth.

How they make

10 Million Wood Screws a Day

By Herbert O. Johansen, with photos by W. W. Morris

IN YOUR home, it's a good bet there are at least 10,000 screws—in closets, cabinets and especially furniture. A divan or dining table has from 100 to 200, a piano several hundred. All told, more than 10,000 different kinds are made, adding up to a yearly total of five billion wood screws alone.

They come in more than 20 lengths, in 18 sizes, with a dozen different heads, in half a dozen metals and a variety of finishes. One of the smallest, a ⅜" No. 2, is popular for fastening down model railroad track. Giant six-inchers hold together wharf pilings and panels for prefab houses.

To find out how wood screws are made, we visited the sprawling plant of the Southern Screw Co., in Statesville, N.C. On its machines—many of them designed by the company itself—more than 10 million screws can be made a day.

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1 COILED WIRE is the raw material from which wood screws are made. The most popular metals used are: steel, for economy and strength; brass, for rust-resistance; aluminum, for lightness; and stainless steel, for both high strength and resistance to corrosion.

2 HEAD IS PUNCHED by header machine, above and in close-up below, after wire has been cut to right length for size of screw being made. Average machine will punch 200 heads a minute. Screws are then ejected into hopper and carried to head-slotting machines.

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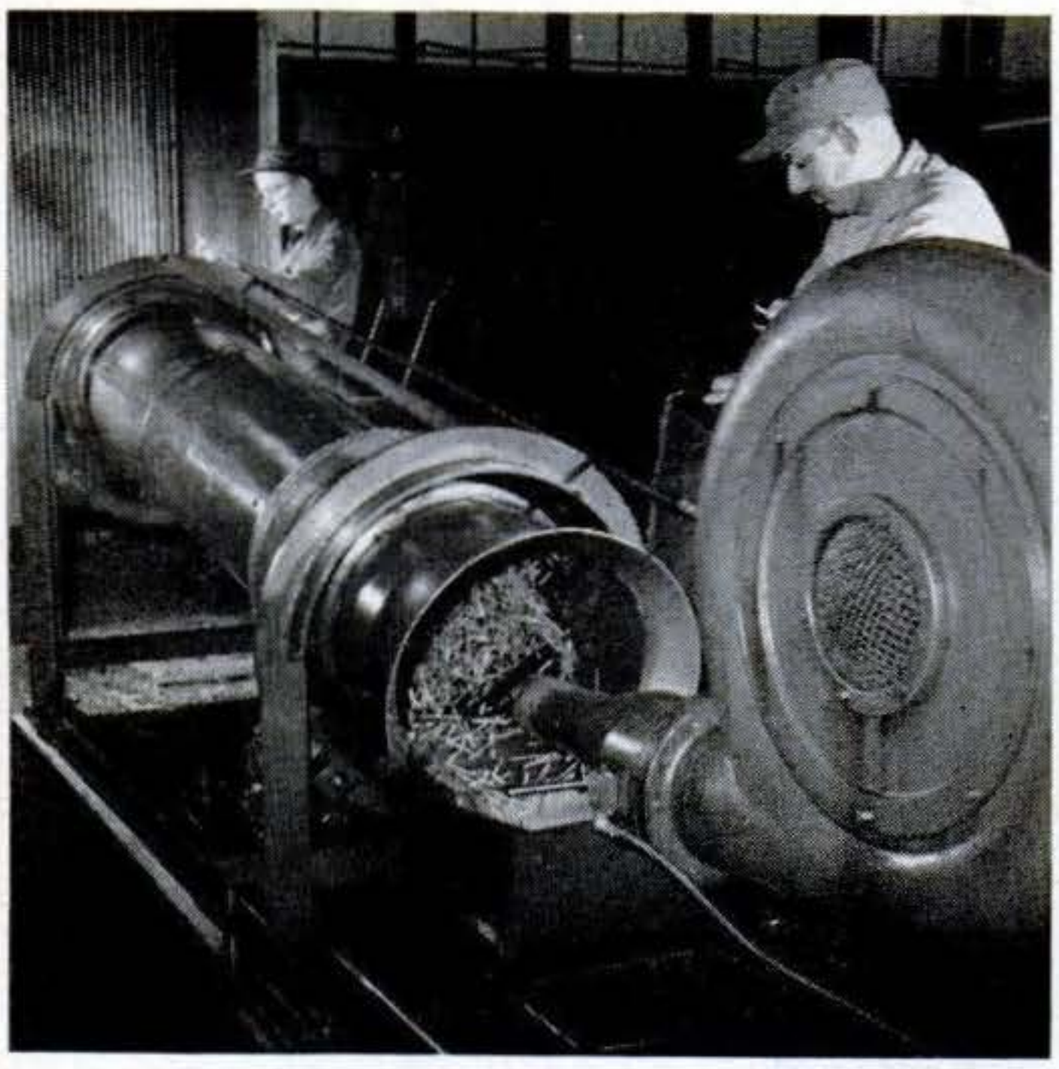
3 CLAMPED INTO NOTCHES on a wheel, the blanks coming from the header pass under a rotary saw that slots the heads. Screws are fed into the wheel by means of a narrow channel that automatically turns them right side up, ready for the cutting operation.



5 TUMBLED IN WIND TUNNEL after cutting is finished, the screws are separated from turnings, which are blown out back of open-ended cylinder. Scrap is collected and sold.

6 DUMPED IN OIL to prevent rust, steel screws are then dried and packed. A thin, protective coating of oil remains on them. Other screws are plated to give a decorative finish.

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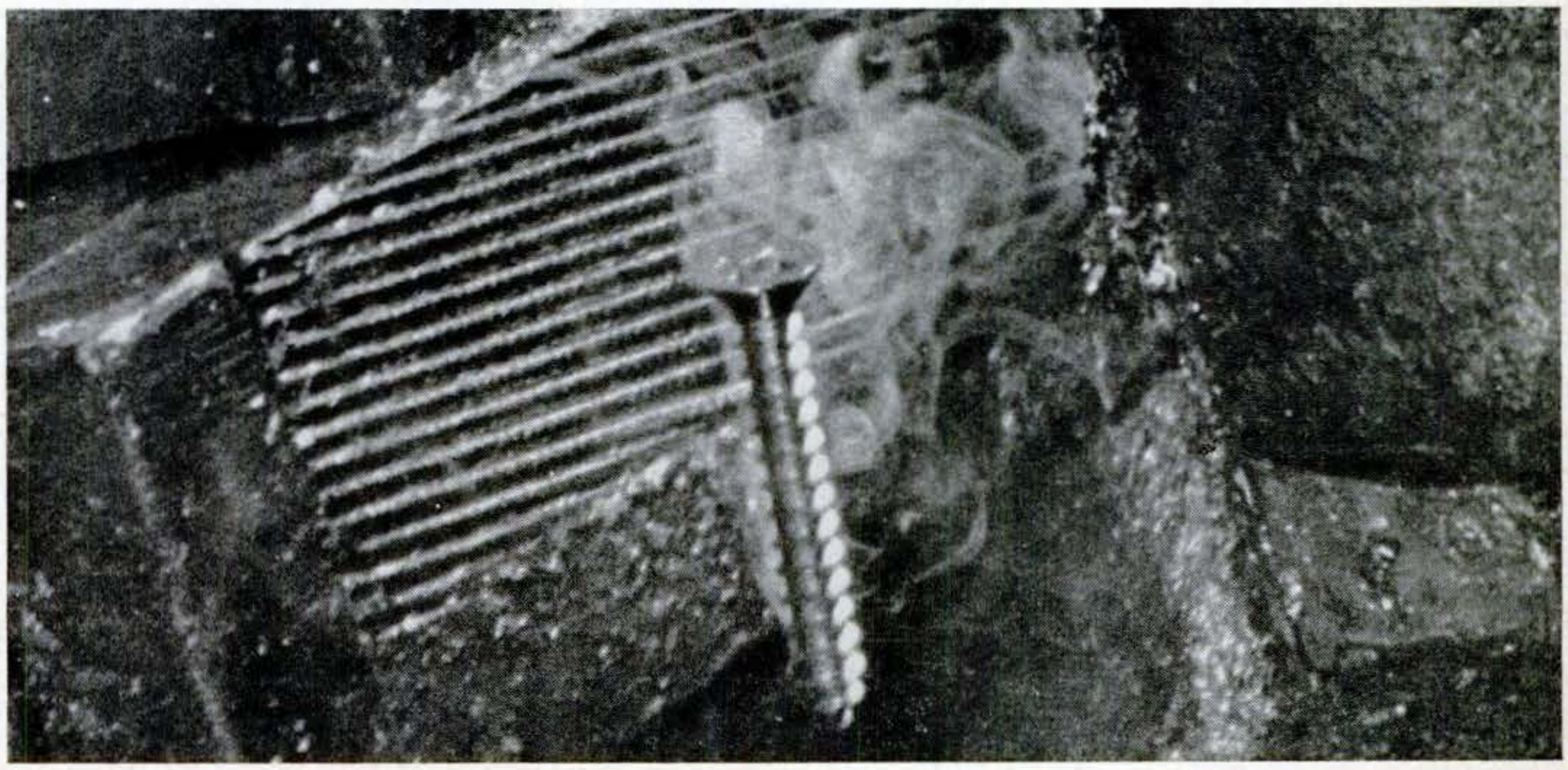
4 **WOOD-SCREW THREADS** are lathe-cut on this rotating spindle. As the screw spins, a form tool makes repeated passes, cutting the helical thread. Another cutter on the machine shapes the gimlet point. At right, a finished screw is automatically ejected.



HIGH-PRESSURE DIE-ROLLING, rather than lathe-turning, forms the threads in sheet-metal screws and others, such as those that are threaded at both ends—like dowel screws and hanger bolts. Die-rolling permits the threads to be shaped to special contours, and eliminates wasteful shavings. Here the moving die releases a freshly rolled, smoking-hot screw. END

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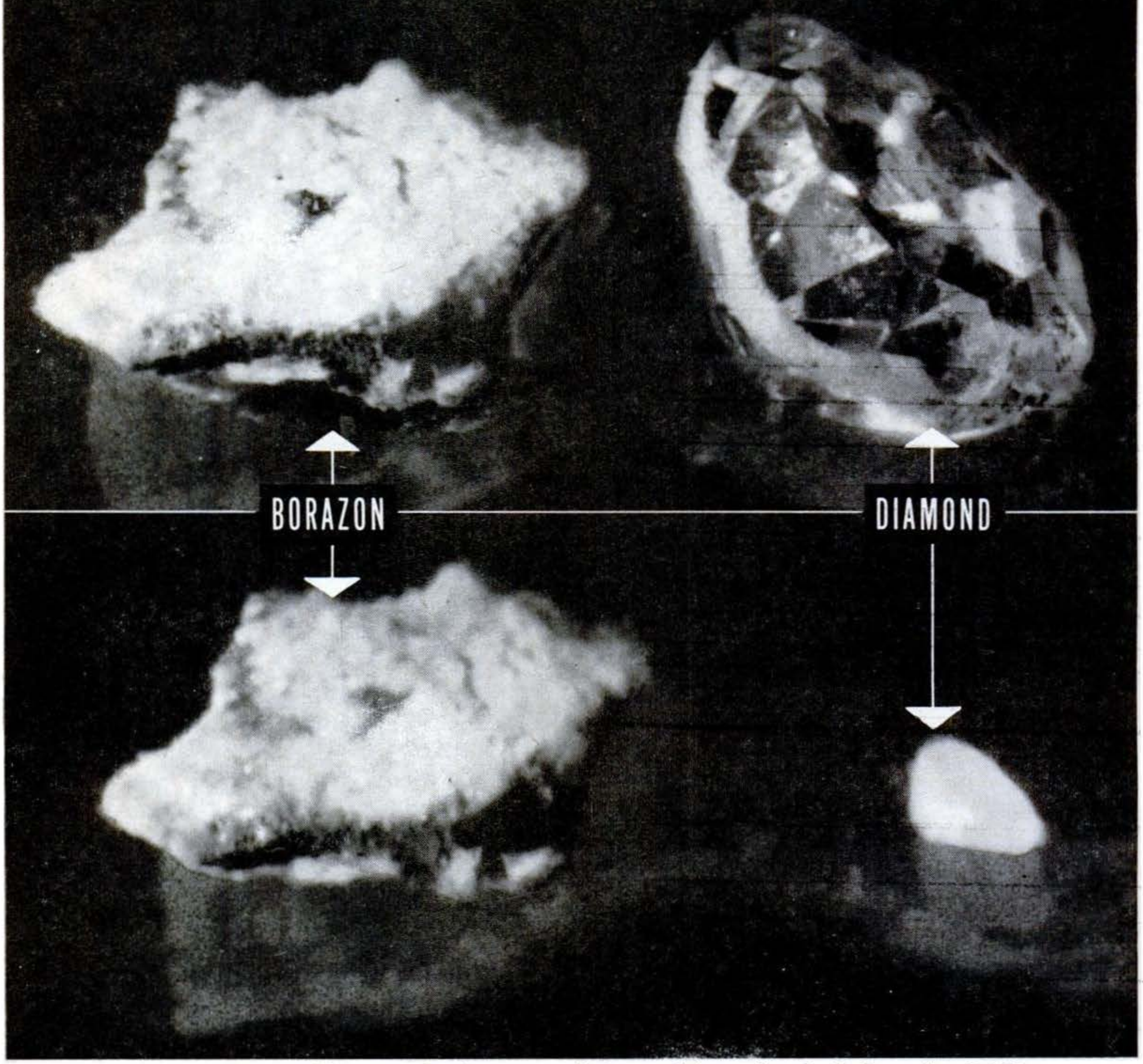
Man-Made Material Is Hard as Diamond



SUPERIOR HEAT RESISTANCE of borazon, hard as diamond, is shown in highly magnified photos. In top view, borazon and diamond are placed on platinum ribbon, electrically heated to 2,000 degrees F. Lower view, 2½ minutes later, shows diamond burning up. The borazon remains intact.

PROUDLY displayed to reporters, some weeks ago, were a few specks of what may be the hardest substance in the world—cubic boron nitride, or borazon (from boron and azo, which refers to nitrogen) for short. Through a magnifying lens, viewers saw rocklike particles of mixed tints: white, yellow, red, brown, gray, black. Only a few grams of the man-made material, a fraction of an ounce, exist to date. But if it can be mass-produced, at reasonable cost, it will work wonders in industry.

For borazon is called "certainly as hard as diamond, probably a little harder," by Dr. C. G. Suits, General

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Electric Company's director of research. Both to scientists and toolmakers, that claim makes astounding news.

Unchallenged until now, the diamond has been the king of all hard substances. That's why costly and "strategic" industrial diamonds, imported literally by the ton from Africa and Brazil, are set in the tips of the tools that cut and shape the hardest modern alloys.

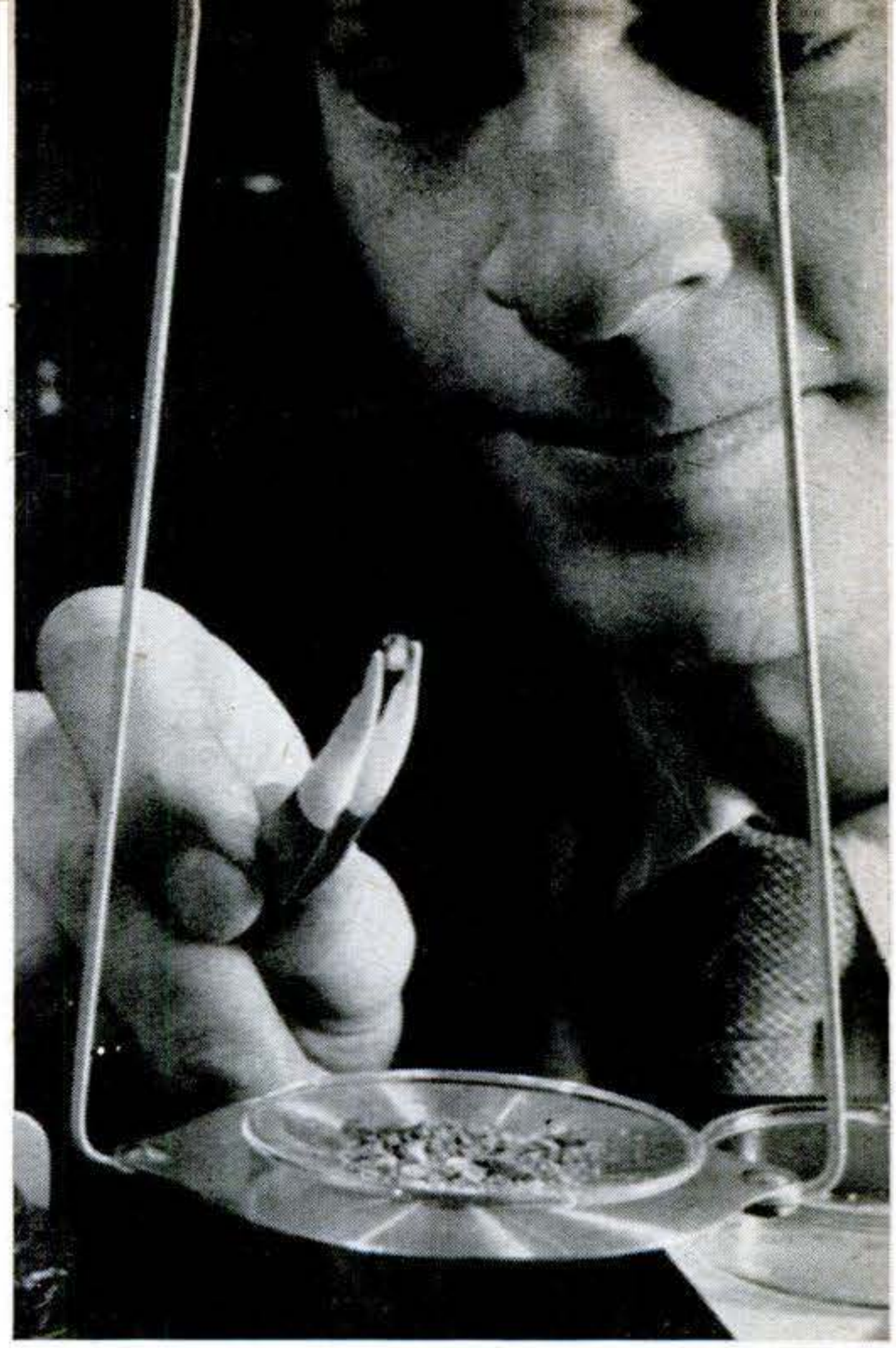
Nothing even approaching the diamond in hardness has been known before. In fact, scientific arguments have been offered in print, "proving" that nothing else could possibly be as hard as a diamond. Now Dr. Robert H. Wentorf Jr., young GE physical chemist and creator of borazon, has accomplished the "impossible" by making such a substance.

Simplest evidence of his feat is the familiar scratch test for hardness. Traditionally, "only a diamond can scratch a diamond." But borazon and diamonds scratch each other, showing their hardness to be practically equal.

To measure more precisely the relative hardness of two substances at the very top of the scale, a "lapping" test compares the rates at which borazon and diamond dust can grind away a measured diamond. By a narrow margin, borazon appears superior in hardness.

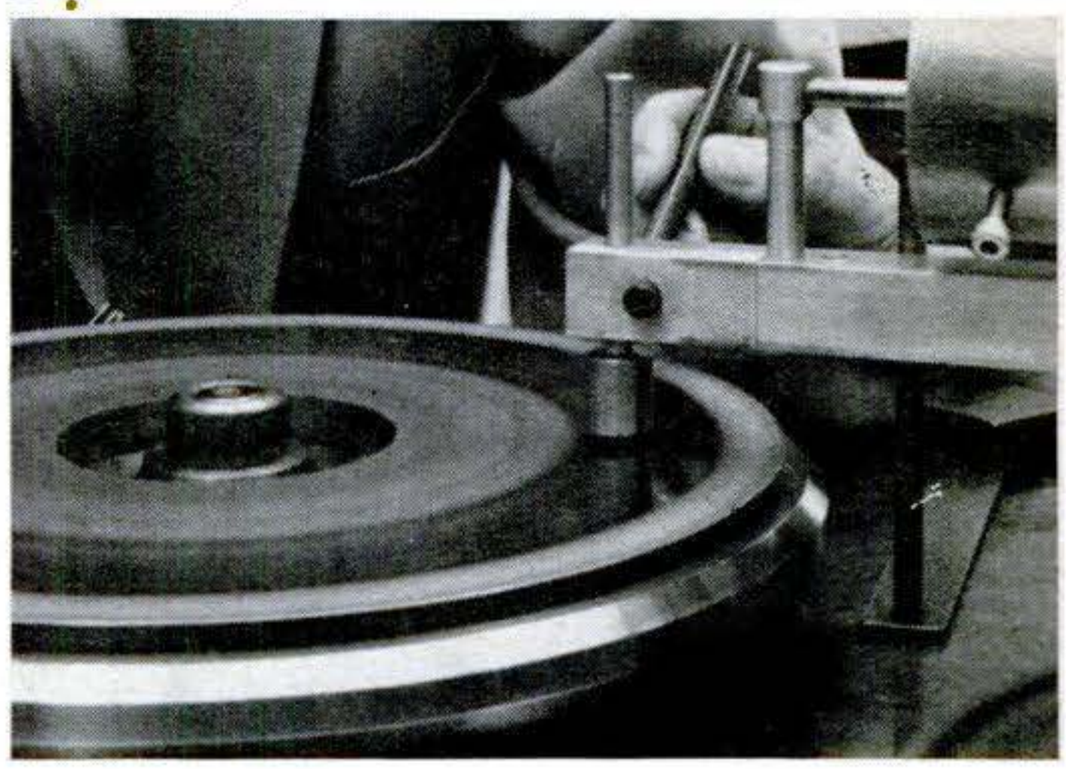
Far greater is borazon's superiority over diamonds in resistance to heat. For industrial tools, which get hot in use, this is a big advantage. Borazon should permit faster production without risk of damaging valuable tools.

Just as hard diamond and soft graphite both are carbon, so hard borazon and the ordinary soft and white form of boron nitride have the same chemical formula, BN. Each is a solid compound of boron and nitrogen, the two elements that straddle carbon in the chemist's periodic table; and what makes all the difference is their crystal form. As in graphite, the atoms of ordinary boron nitride's "hexagonal" crystals form loosely joined layers, sliding easily upon each other. As in diamonds, atoms that make up borazon's "cubic" crystals are locked together in a tight, compacted block.



DR. ROBERT H. WENTORF JR., 30-year-old GE physical chemist who accomplished what theorists had called "impossible," examines a few grains of the diamond-hard borazon he created.

"LAPPING TEST" clinches the proof that borazon is hard as diamond. It compares rate at which borazon and diamond dust, on revolving wheel, grind away a measured diamond on arm above.



Unlike the diamond, borazon doesn't exist in nature. So Dr. Wentorf didn't know, when he began, if it could be made at all. Just how he did is still his firm's trade secret. But General Electric reveals that the method uses a temperature of 3,000 degrees F. and a pressure of about a million pounds to the square inch.—*Alden P. Armagnac.*

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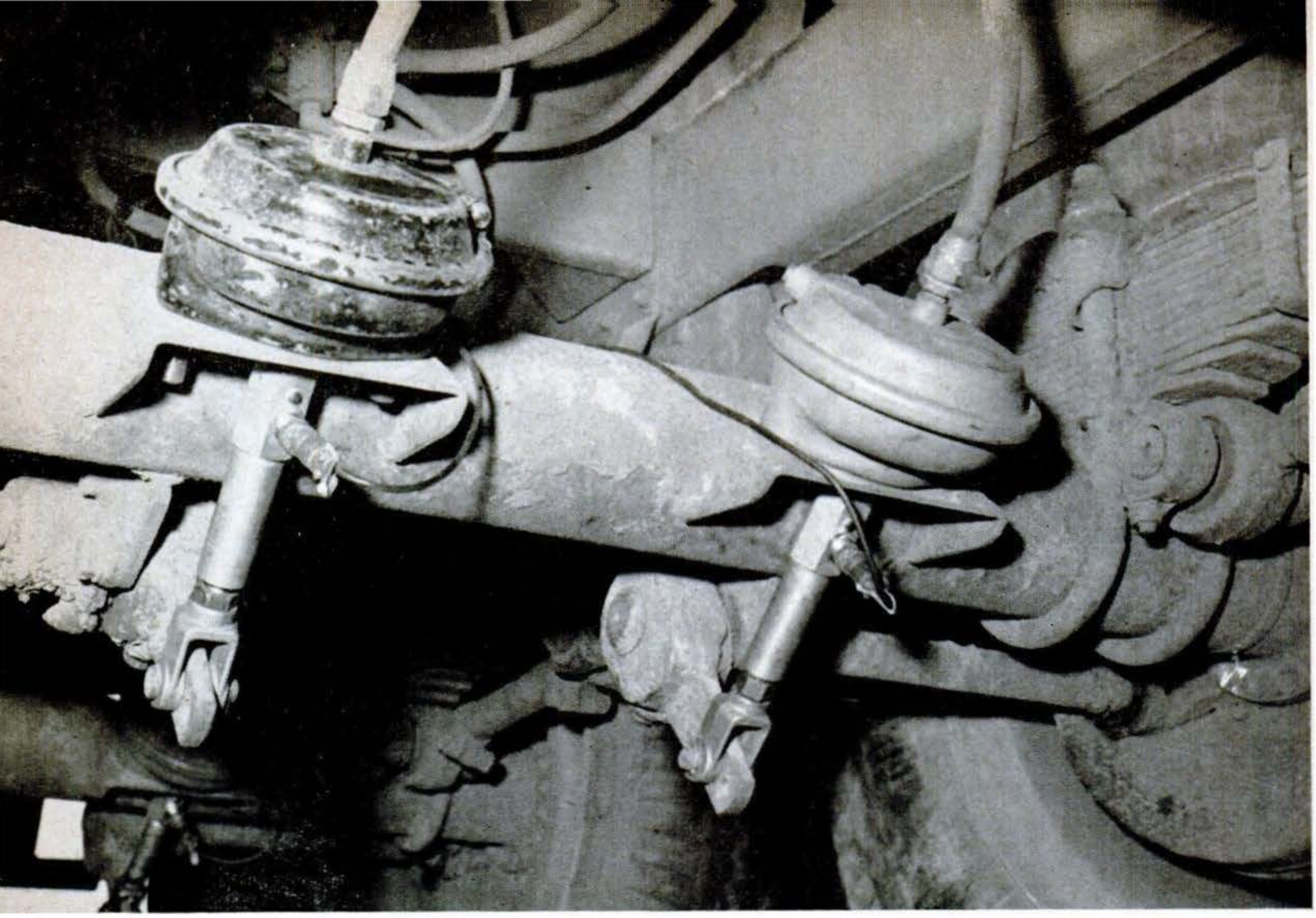

POWDER-CHARGED CYLINDERS function, under normal conditions, as part of the push-rod system that runs from air chamber to wheel brakes. Electrical connections shown here are temporary.

Now they're trying: Gunshot Brakes for Runaway Trucks

A tractor-trailer unit . . . was traveling south on New York Highway 17 into the town of Liberty, N. Y. . . . As it descended a long downgrade toward the town, its brakes failed. Out of control, the vehicle continued into Liberty with resultant collision and fire. Sixteen other motor vehicles and a pedestrian were involved, three persons were killed, 14 injured, and property damage totaled $40,000.—Accident report, Interstate Commerce Commission.

SUCH runaway accidents may be prevented in the future by a new gunpowder-activated brake that uses the principle now successfully employed to eject pilots from planes in supersonic flight.

Developed by the Talco Engineering Co., of Hamden, Conn., the brake is simply a four-inch metal cylinder containing a piston and a powder-filled chamber. Installed on the rear axle—or axles—of a truck or trailer, the cylinder becomes part of the push-rod system that applies the wheel brakes.

If the driver suddenly finds himself with no brakes, he flips a switch, closing an electric circuit to the powder igniter. Instantly, hot, expanding gases build up enough pressure to force the piston out, applying the wheel brakes.

In a recent demonstration of the new system, the driver of a 25-ton tractor-trailer going 30 m.p.h. brought his vehicle to a dead stop within 51 feet—a shorter distance than would have been

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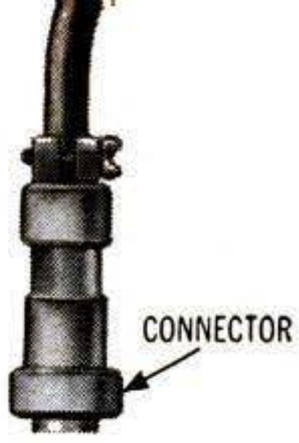
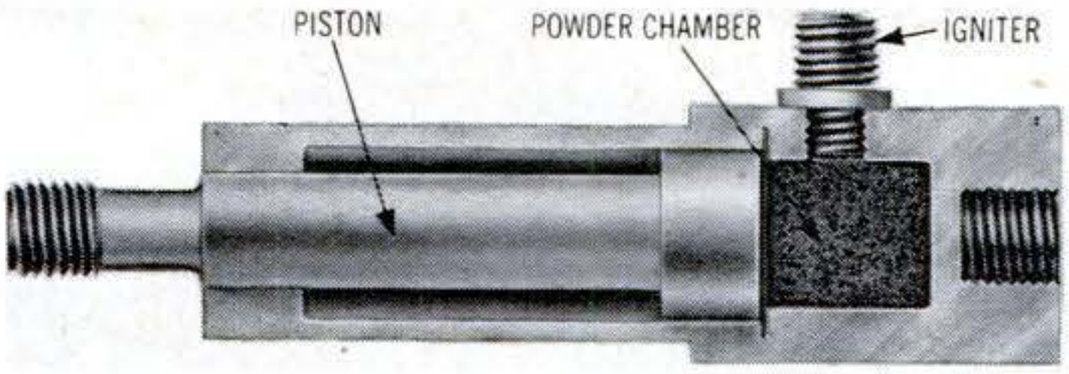
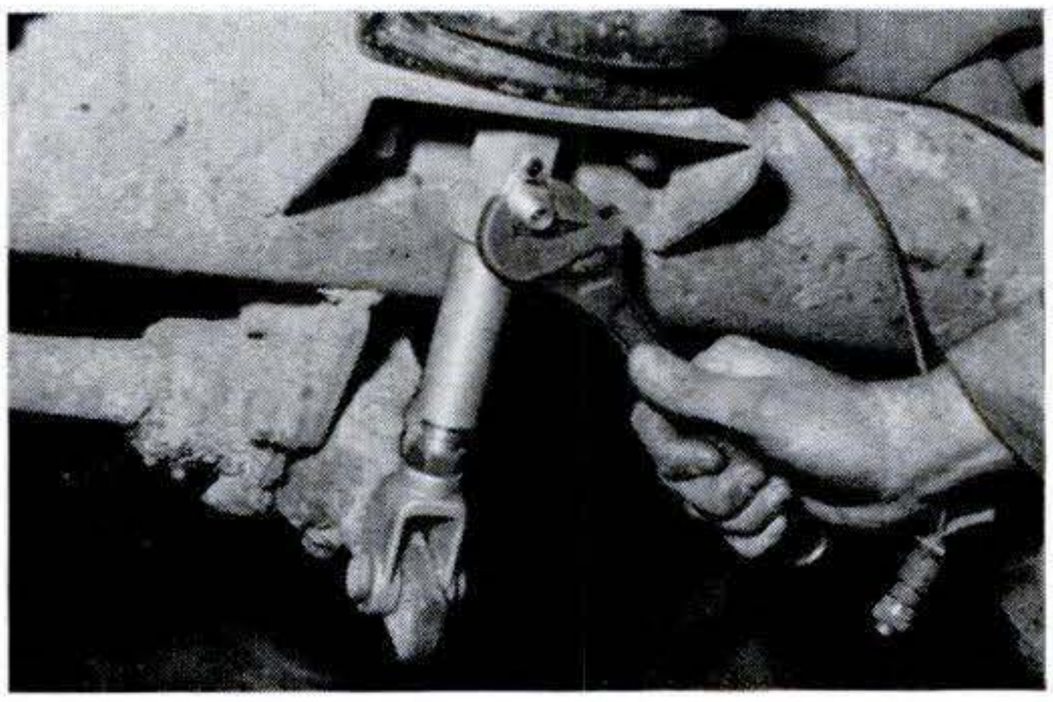




SETTING OFF SPARK inside igniter explodes powder charge. Expanding gases shoot piston out to move push rods normally operated by air.

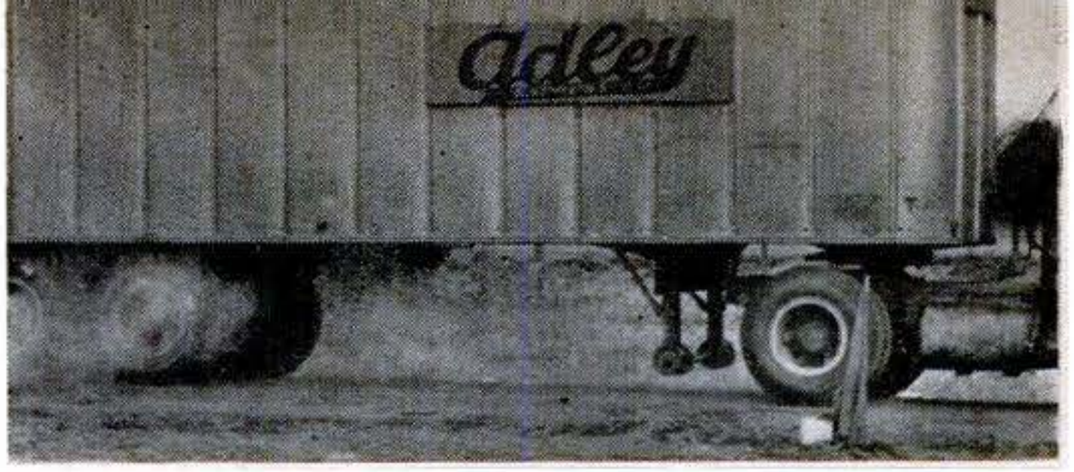


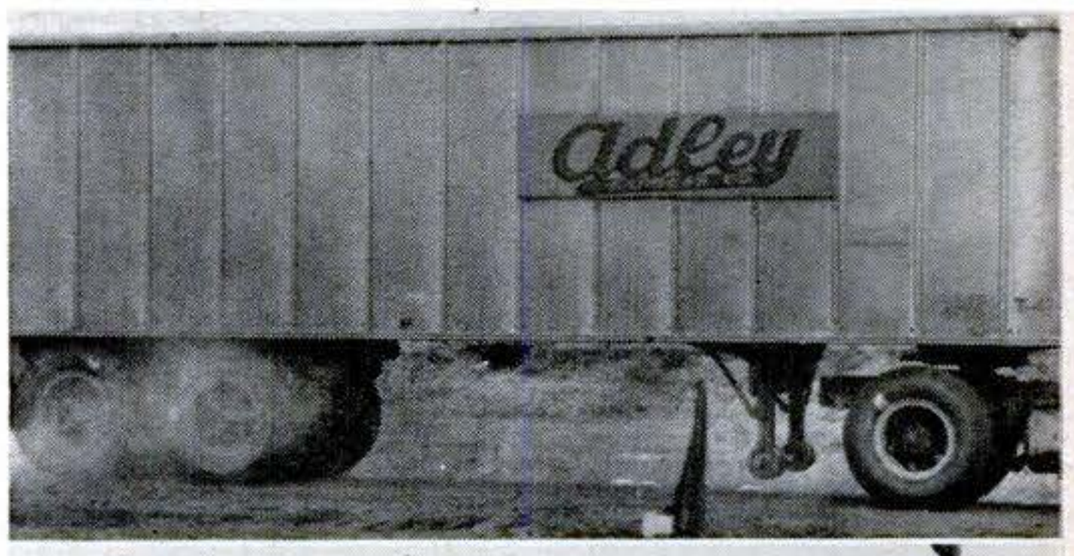
ONCE CHARGE IS FIRED, driver has to bleed off pressure before the wheel brakes will unlock.

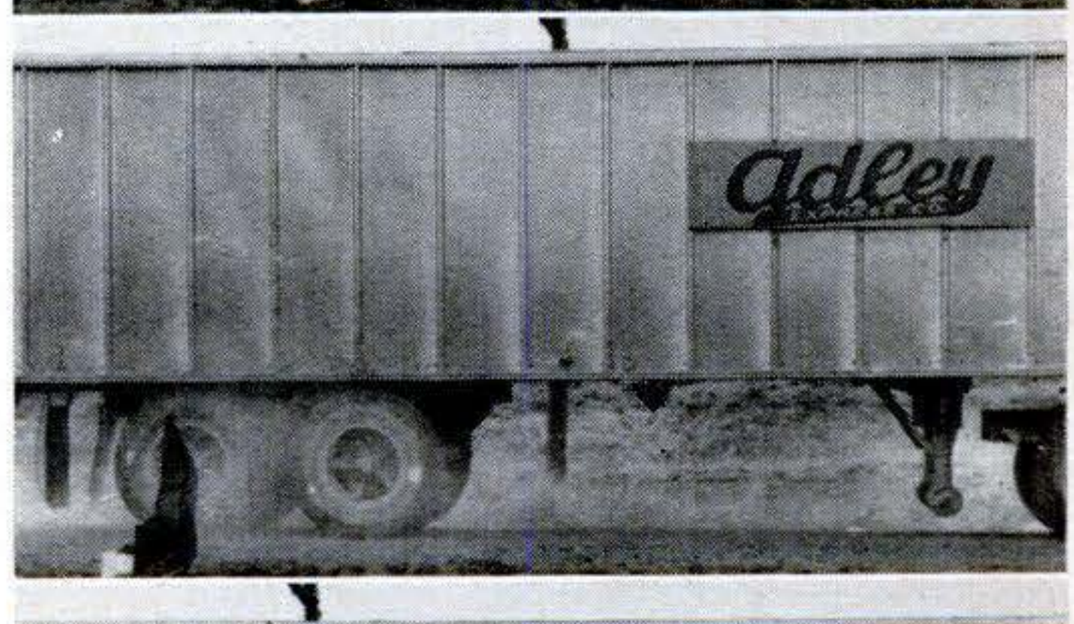
possible if he had put full press on the air brakes.

The powder can be fired with the current in a virtually dead battery. And in case of a breakaway between tractor and trailer, the system would fire automatically. If the explosive should go off accidentally in fast traffic, the risk of rear-end-collision might be lessened by an emergency stop sign that would light up.

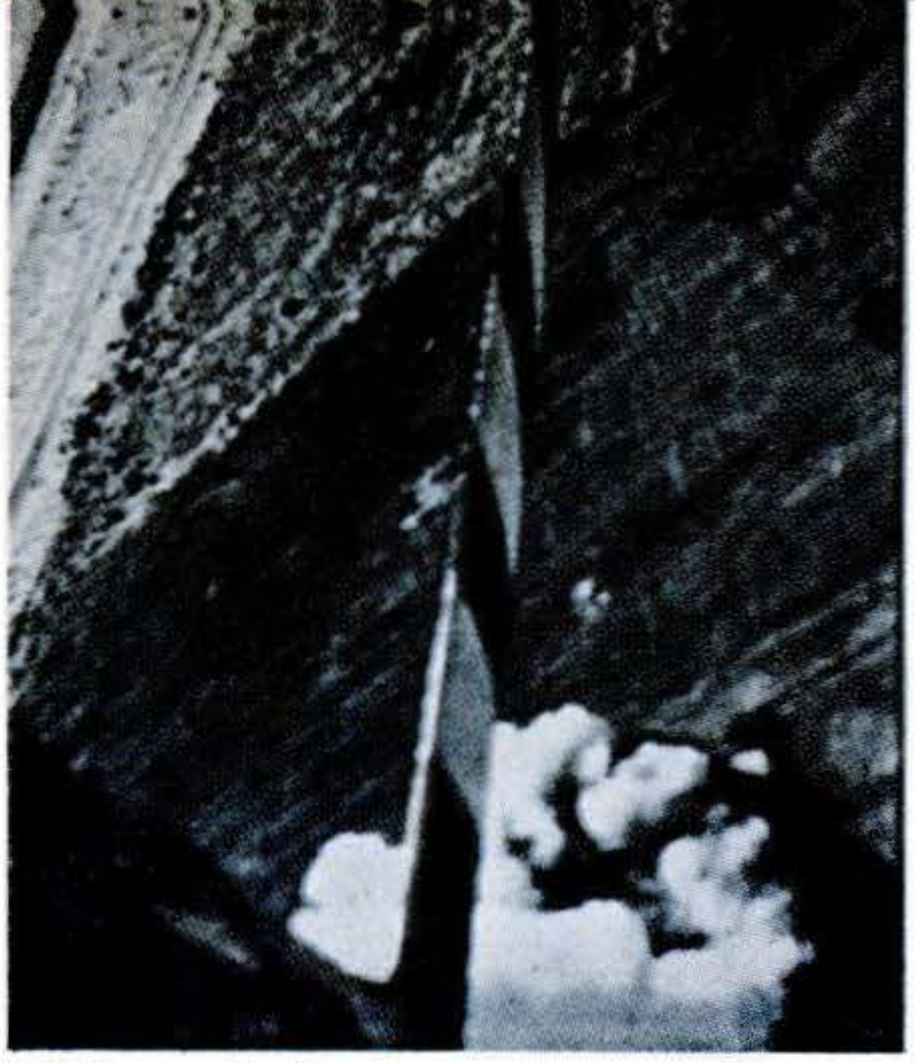
All this doesn't mean that air brakes are on their way out. They're still highly efficient, and recent ICC regulations make them even more so. But since the new gunpowder brake is completely independent of the air system, truck drivers of the future may have a better chance of stopping safely and swiftly in an emergency.—*Herbert O. Johansen.*

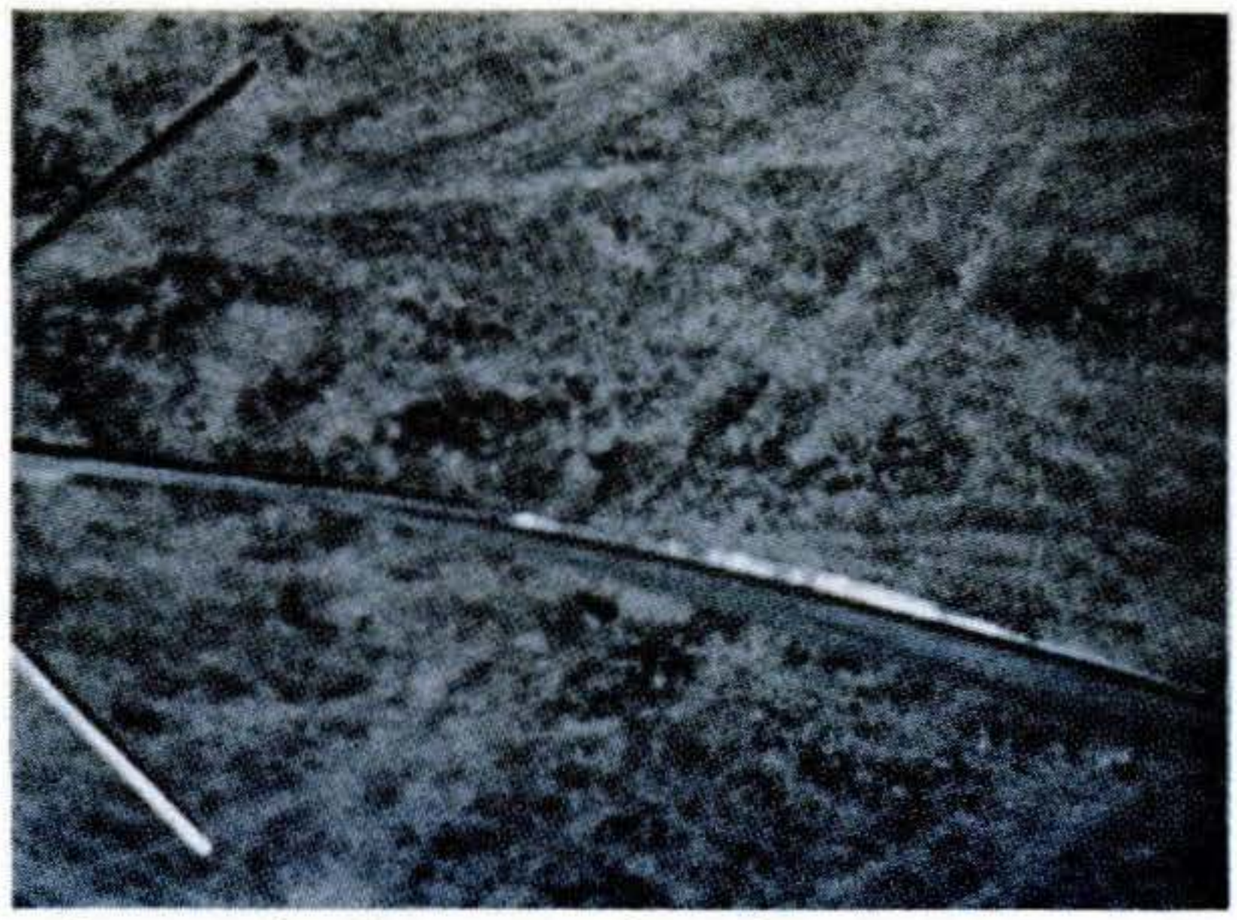






PANIC STOP of a 25-ton trailer is caught by PS photographer with a Hulcher sequence camera. Wheels grabbed and chattered at high speed. The smoke is from sliding rubber, not powder.





Riding missile, camera snaps booster smoke at takeoff . . . wing bent by air load . . . aileron

Shooting thousands of pictures a second—

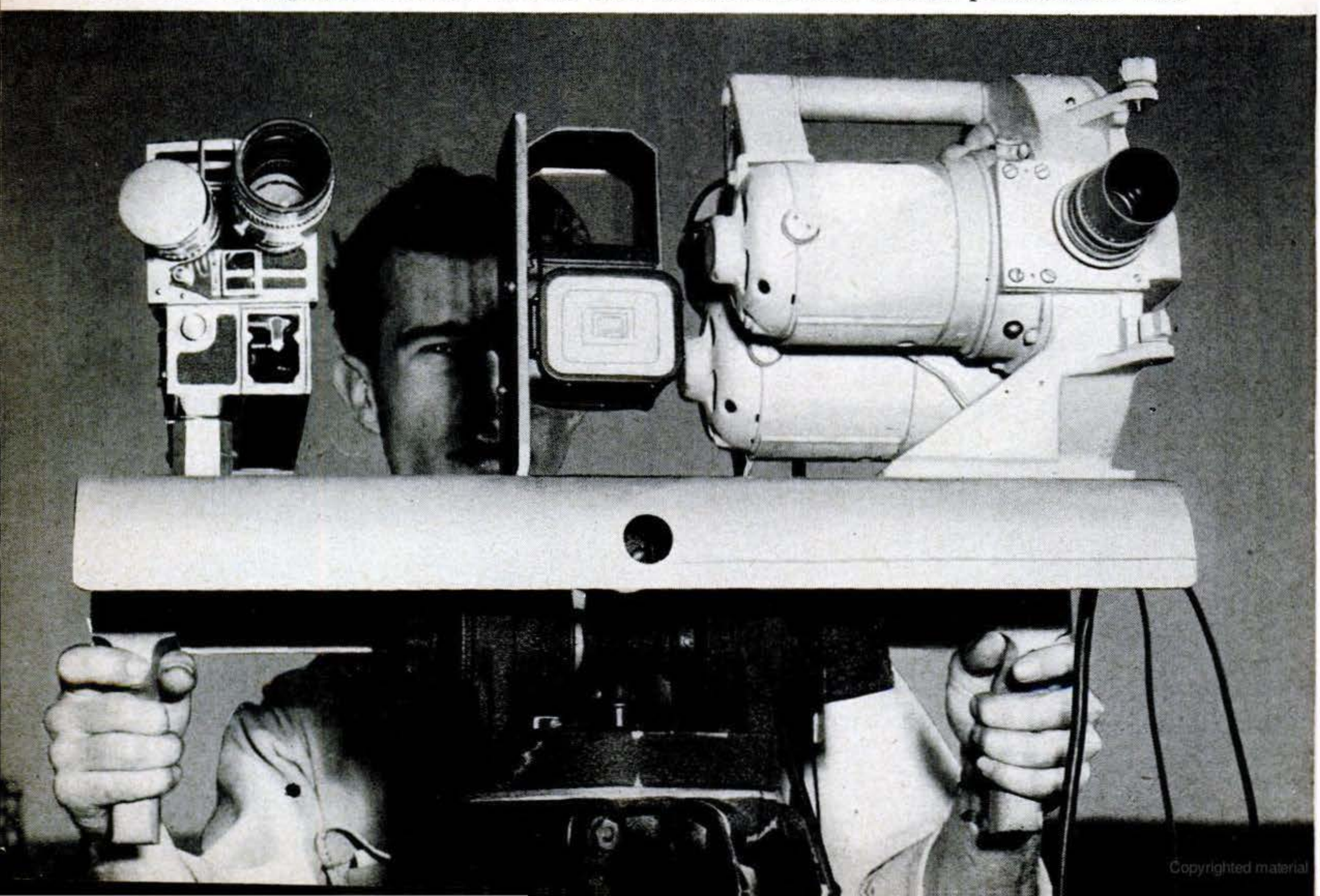
These Cameras

OVER a loudspeaker comes the ominous voice of a technician counting down seconds:

"Eight . . . seven . . . six . . . five . . ."

Cradled in a launching platform on the desert floor at Holloman AFB in New Mexico is a long, slender experimental missile. Hidden from view, inside the missile, is a little box that shortly will become all-important to a group of

Fastax camera (right) is mounted with 16-mm. camera to record aircraft performance tests.



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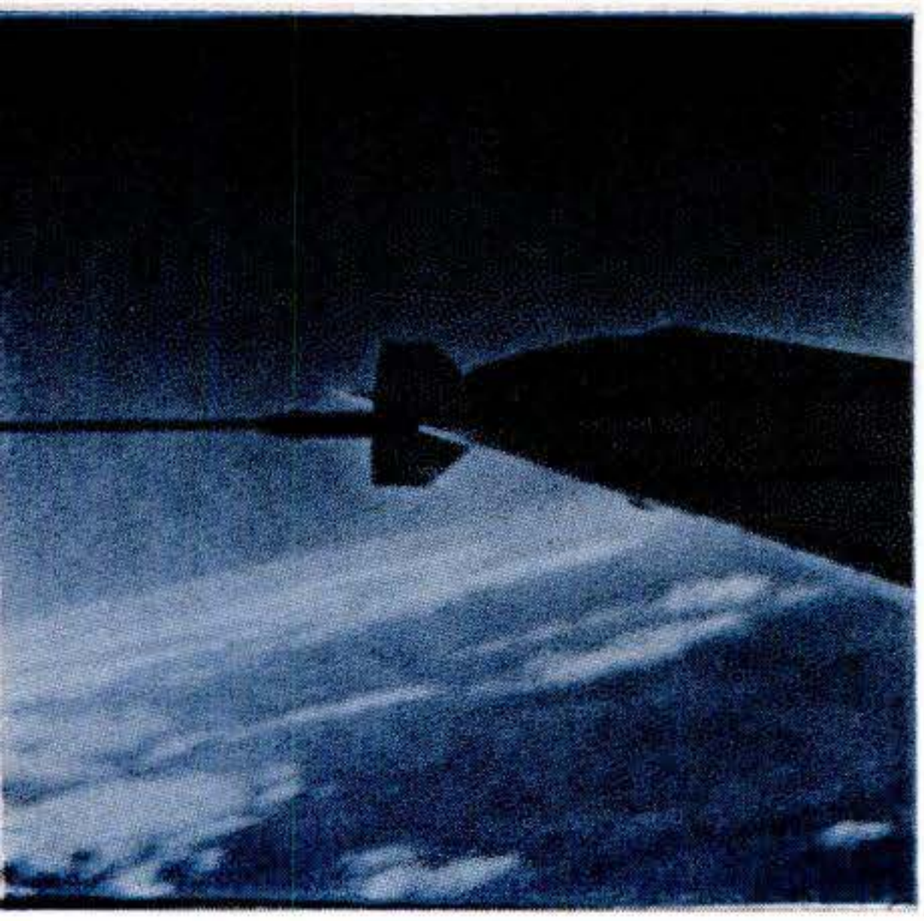
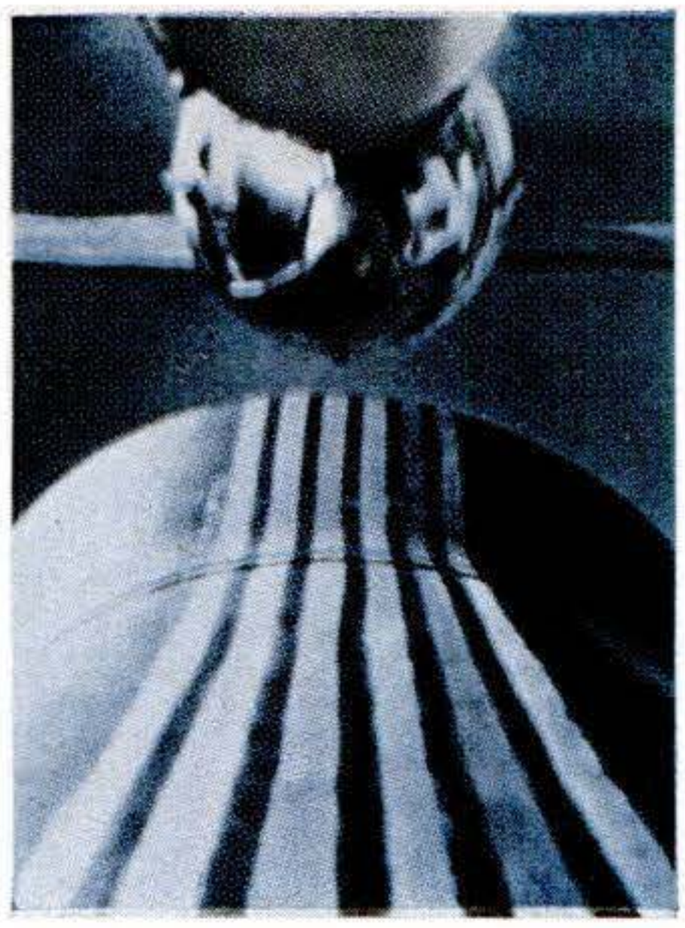

with telemeter antenna . . . missile above its ramjet . . . recovery chute as bird falls earthward.

Make Time Stand Still

tense men inside a concrete blockhouse. Pulses quicken with each ticking second. These men have worked many months for this single moment.

"Four . . . three . . . two . . . one!"

Flaming thunder slams brutally against the desert sands. For one interminable second the missile seems glued to its launcher. And then it is gone, shouting its thunder to the heavens.

The engineers begin to relax. The launching was normal. But this relief is short-lived; seconds later a grim-faced technician turns from a telemetering panel:

"Something's gone wrong. I think the bird blew up."

Only one thing can tell the story: the little box inside the missile—an instrument that reaches out, snatches seconds from time, expands them into minutes and then hands them back to engineers for study.

This box is the high-speed miniature camera that, through a small trap door, records the missile's flight. Home movies are usually snapped at 16 frames per second; this job cranks out hundreds—even thousands—of pictures a second. An incident that occurs in one mere second is later stretched on the projection screen to several minutes.

Three days pass before the engineers find the camera that recorded their missile's flight. A fragment of the missile dug it deep into the ground, crushing it inside its splintered box of protective armor plate. Its film is in fragments. Worse, the camera and film are soaked in alkaline water and mud lying below the desert floor.

From a 100-foot roll, only about 20 feet of developable film is recovered. And that is ripped into some 70 pieces, the smallest of them no more than an inch long.

LUCKILY, these few bits of film, after being washed, developed and pieced together jigsaw-fashion with cellophane tape, make sense in the projection room to engineers. They present this picture:

You are miles above Holloman AFB, traveling faster than sound aboard the experimental missile. The sky is a vivid blue and the ride is smooth until, suddenly, a wing begins vibrating. Now the entire missile shudders. Then, violently, it begins shaking itself to pieces. The

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end is near. Pieces tear away. Now, darkness . . . The missile parts are plunging earthward.

An engineer switches on the room lights.

"That's it," he comments. "Structural failure. Got to reinforce the wings."

Thus, a few dollars' worth of film told the Lockheed people what had happened to a $1,000,000 missile—solving a mystery that might otherwise have cost millions more to unravel.

Use of the high-speed camera in recording missile flights, rocket-sled runs and other tests has already saved aircraft and missile builders immense sums, not to mention endless hours of research. For what the human eye could never see, this camera captures and then recreates in snail's-pace motion.

BECAUSE of limited space inside the missile, the camera obviously cannot carry sufficient film to record an entire flight. But neither does it chew up the load in one gulp. A preset mechanism fires a few feet at a time, stops, then fires again.

Consider the speed of Wollensak's Fastax camera which takes up to 18,000 pictures a second. It will gobble up a 400-foot roll of film in just 2.8 seconds. At a projection rate of 24 frames a minute, however, those fleeting seconds are expanded into more than 11 minutes.

Watch the launching of a Nike as filmed by this camera from the ground: In the projection room the missile moves away so slowly that it seems hardly to be moving at all. Patiently, it seeks out a B-17 target drone, eats into its fuselage. The result is spellbinding: The plane begins to disintegrate. Like autumn leaves shaken from a tree, engines, wings, tail section float earthward.

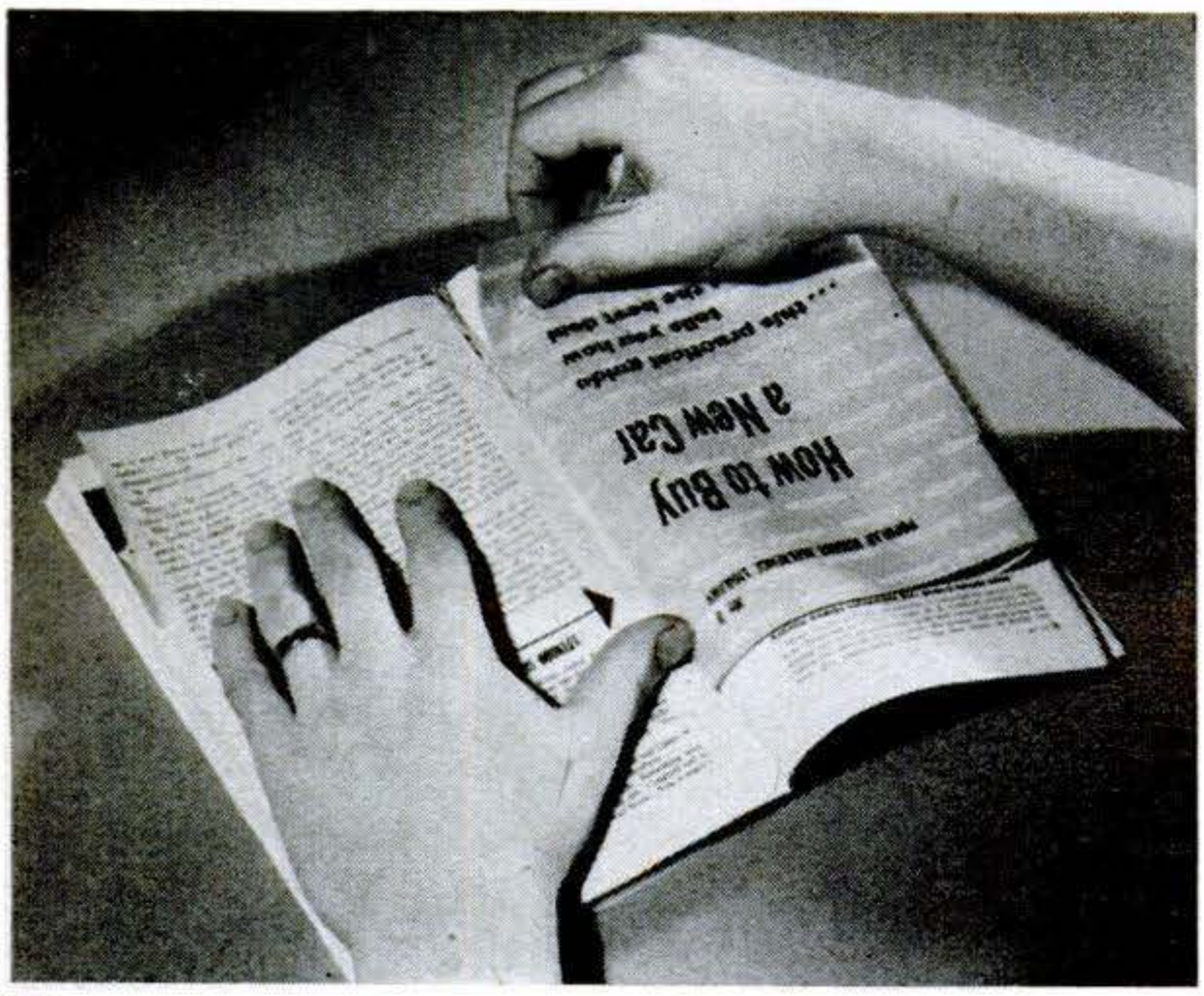
Up at Edwards AFB on the Mojave Desert, speed cameras solved a mystery recently. A supersonic sled carrying a new North American ejection seat screams down the track. On board is a speed camera. Flames, thunder and smoke belch from the sled's red-hot rocket tail. The canopy rips away. Out flies the dummy—but he fails to separate from the seat.

Bruce Enbody, North American's human-factor group leader, learns the answer in a projection room the same afternoon.

This time, however, the sled moves down the track like some lethargic Model

[Continued on page 264]

SPECIAL FEATURE: A TEAR-OUT REFERENCE BOOKLET



HERE is No. 2 in the new Popular Science Reference Library—a fact-filled booklet that takes the complexities out of buying a car.

To remove the booklet, place your left hand firmly on this page, grasp the booklet with your right hand and pull it gently away, starting from the top along the perforated line.

Future issues for your Popular Science Reference Library will contain more time- and money-saving booklets on cars, home improvements and many other important subjects.

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a typewriter for them to be legal, contrary to what some salesmen may say.

You should get a copy of all agreements and papers when you sign. Have the salesman or dealer put all agreements or promises in writing and be sure any changes in contracts are written in and initialed by an officer of the agency. Deposits should also be noted and receipted for. Never drive a new car away from a dealer's while your credit is being looked up or some other part of the transaction is still unsettled. And if for any reason you're not satisfied, take your time and investigate further. It's your money.

If this sounds like too much work, you can buy a new car by a simpler method. Go to your bank and withdraw 30 crisp new century notes. Visit the first showroom you see. Get the price of the car you want and plank the cash down on the salesman's desk. Only be quick to catch him when he faints, so he won't hit his head on the floor.

Glossary

BALLOONING—Making out a finance note with uniformly low payments except for the last, which covers a huge unpaid balance.

BLUE BOOK—National Automobile Dealers Association catalogue giving a range of values for all used cars.

BUSHING—Offering a sensationally low price to lure a buyer and then later having the offer thrown out.

CASH DIFFERENCE—Difference between delivered price and trade or discount.

CLEAN DEAL—One untainted by a trade.

FAST SHUFFLE—Getting a customer to sign a blank contract.

HIGHBALL—Offering a very high trade-in allowance with results similar to "bushing."

HOCK YOUR STICKS—Mortgaging furniture to get down-payment money.

LOWBALL—Either similar to "bushing" (mentioning an unbelievably low price) or giving a rube a very low trade-in.

MICKEY MOUSE DEAL—Any deal in which the customer, with hardly any trade-in, starts out with little cash.

PACK—An arbitrary sum tacked onto the price of a car, accessories, finance charges, or anywhere else the dealer thinks it won't be noticed.

ROMANCING—Giving the customer the red-carpet treatment to soften him up.

SWITCH—Luring customers by advertising a bargain price, then switching them to a more expensive car.

UNHORSING—Getting a customer's car, ostensibly to have it appraised.

WOULD-YOU-TAKE—A card with a printed or written question—"Would you take $xxxx for your car?"—stuck on parked auto. Offer is sky high.

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be made at a very nominal rate if you buy the insurance directly from a broker or insurance agent.

Another way to save on insurance is to carry $100, instead of $50, deductible. With the former you pay out of your own pocket for the first $100 of any repairs or damage to your car; with the latter you pay only for the first $50. The difference in cost may come to as much as $20 a year.

The final accounting

When you've finished your negotiations you should get an accounting from the dealer with every item listed separately and identified (see model bill shown below). Until you've got this, and every blank space on any paper or contract you're asked to sign is fully filled in, don't sign anything. It's not necessary for contracts to be filled in on

A Sample Bill

Your papers from the dealer should include a completely itemized accounting of all costs in connection with the new car, the trade, the financing and the insurance. Every entry should be identified. The following itemization is based on an actual accounting on a 1957 station wagon.

STATION WAGON, model 000, delivered price, including "handling and make-ready" and all taxes	$2,738.00
HEATER, type xxx	69.40
RADIO, type xxx	69.40
UNDERCOATING	25.00
BACK-UP LIGHTS	8.00
AIRFOAM CUSHION	9.15
ACCESSORY GROUP XYZ (armrest, sun visor, windshield wiper on right-hand side)	16.70
TOTAL PRICE OF CAR	$2,935.65
TRADE-IN ALLOWANCE on 1951 wagon, model 000	935.65
NET COST	$2,000.00
INSURANCE, $100 deductible collision, fire, theft, and comprehensive coverage for one year	64.00
TOTAL TO BE FINANCED	$2,064.00
FINANCE CHARGE (Blank Co.) at $5.75 per $100 per year for 24 months	237.36
FINAL TOTAL	$2,301.36
MONTHLY PAYMENTS	95.89

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Insurance

You can't finance a car without some insurance, because the banks or finance companies want to protect their investment. They don't care whether you protect yourself by carrying property damage and liability coverage, but they do insist on your having collision, fire, theft and comprehensive coverage (windstorm, etc.). Not infrequently, dealers use such windy phrases as "complete coverage," giving the impression that the limited insurance they're selling includes a great deal more than it does.

COMPLETE COVERAGE

Don't let "complete" fool you

Insurance rates are regulated by state insurance departments, but a certain amount of variation is allowed. By getting the insurance itemized as a separate figure on your bill, you can easily check up on the cost. You may find, for example, that it's easier and cheaper to get all of it through the same firm that gives you your property-damage and liability coverage.

Recently Better Business Bureaus have exposed one racket that netted some of the insurance companies affiliated with auto-finance outfits large sums. (General Motors Acceptance Corp. and its insurance affiliate were notably absent from the list of culprits.) Insurance for cars operated at any time by male drivers under 25 is very expensive. Often new-car buyers were asked whether their cars would be driven by anyone under 25, but the insurance somehow still was misclassified. Be sure you're put in the right rate group or you may find your premium doubled.

When a car is financed for several years, the dealer usually suggests taking out a single insurance policy for the whole period. There is no advantage to a three-year policy. The rate is less than three times the cost of the first year, but on a year-to-year basis it would also fall, because the value of the car falls. On the other hand there is a disadvantage to paying for and financing a three-year policy. That way, you also pay interest on the insurance charges. It is much better to buy the insurance year by year, and best of all not to include it in the finance plan at all. Sometimes a separate time-payment arrangement can

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Read the small type

Some of the clauses in finance contracts are almost as shocking as the prose of Mickey Spillane. For example, many form contracts have the buyer signing away all rights of recourse against the seller. In a number of states that is no longer legal, but there are other kickers, concerning the details of repossession, for example, which may be outright piratical. Bar Association referral services report that difficulties arising from conditional-sale contracts cause more of their cases than anything else, so if you have any doubts at all about a contract, ask a lawyer to look it over.

On the plus side of many contracts is the inclusion of life insurance, paying off the unpaid balance in the event the purchaser dies. But watch out for the finance plan that's sold to you on the basis of your statement of what you want to pay each month. Sometimes salesmen let customers set their own payments at any level they want, slipping them a delayed-action bomb in the form of a "balloon note" (see glossary on page 14).

How to Figure Interest Rates

The old-fashioned kind of interest taught in school is called simple interest, and it is simple to figure. It's a straight percentage. For example, if it costs you $6 to borrow $100 for a year and you repay the principal at the end of the period, the interest rate is six percent. But if you pay $6 to borrow $100 to finance a car, repaying in 12 monthly installments, the real interest is a lot higher. The payments would be $106 divided by 12 —$8.83 a month. Actually, of course, you would not be borrowing $100 for a year. You'd be borrowing $100 for one month, $91.17 for the next month, $82.34 for the third, and so on. Adding all these balances together and dividing by 12, you get an average figure of $51.44 borrowed for a year. The $6 charge then becomes 11.7 percent, or roughly twice the apparent rate.

When, therefore, a bank says it is charging $3.75 per hundred per year for an automobile loan, the effective interest rate is about 7½ percent.

In some of the states having auto-finance laws, the maximum legal charge for new-car financing is $7 per $100 per year, or, in reality, about 14 percent.

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Typical Finance Charges

The finance charges below, which are higher than many bank charges, were compiled from General Motors Acceptance Corp. recommended rates. The nominal interest rate works out to around 6½ percent (but see page 11). This includes a small sum for life insurance. Some other finance companies may charge more. (Upper figure is total finance charge; lower figure, monthly payment.)

LOAN	12 MOS.	18 MOS.	24 MOS.	30 MOS.	36 MOS.
$1,000	$ 65.60	$ 97.28	$129.44	$161.60	$193.76
	88.80	60.96	47.06	38.72	33.16
$1,500	97.20	144.84	192.96	241.20	289.56
	133.10	91.38	70.54	58.04	49.71
$2,000	128.80	192.40	256.48	320.80	385.00
	177.40	121.80	94.02	77.36	66.25
$3,000	192.12	287.52	383.52	480.30	576.96
	266.01	182.64	140.98	116.01	99.36

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The cost of credit

Once you've picked the dealer and fixed the price, you've got to come up with the long green. That usually means financing, which has cost more unnecessary money than any other part of new-car deals. Until very recently most state laws had a neat legal fiction that straight loans and time purchases were entirely different breeds of cat. Interest rates on loans were regulated, but time purchases weren't considered loans. The amount you paid for borrowing on a time purchase was considered part of a separate price—the time price—distinct from the cash price. There was generally no legal limit to time prices.

day about a third of the states have laws regulating bile-finance arrangements in some fashion, but, ide variation is possible. In approximate order st, here are the principal methods of raising y:

bank loan, secured by stocks, bonds, real estate, etc. Loans of this type mp sums at the end of the term. is left with the bank, any income

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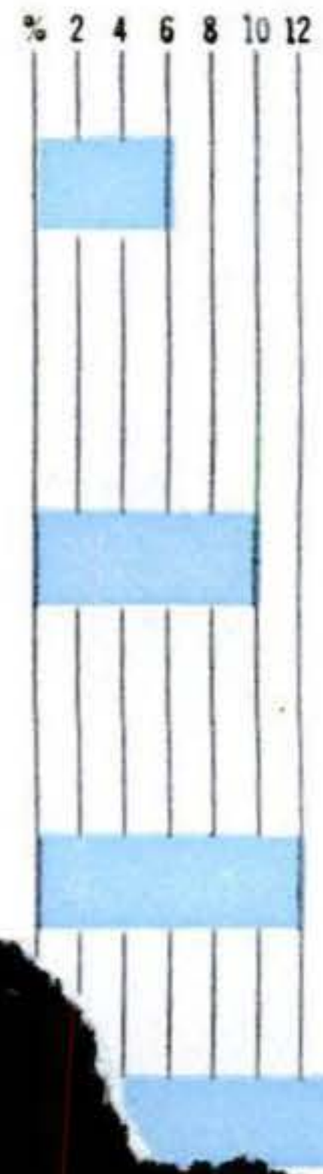

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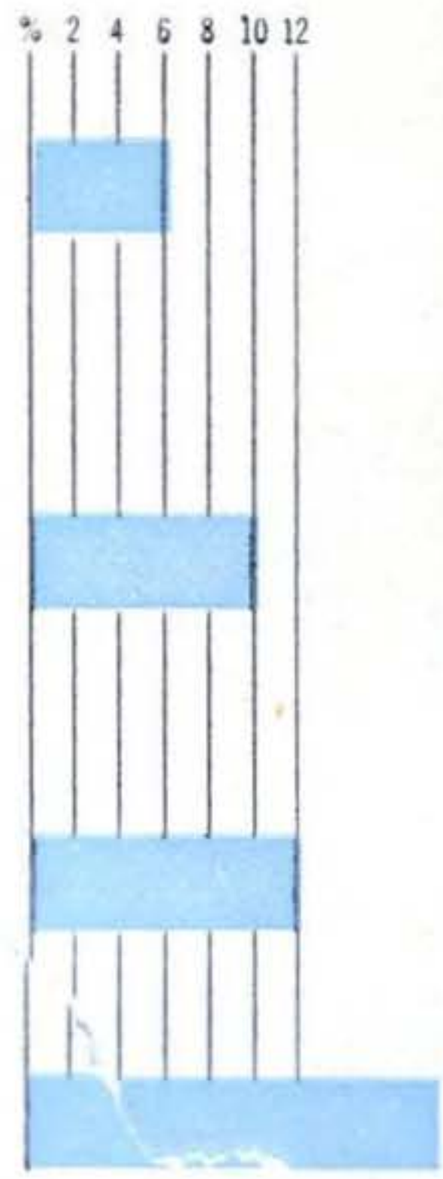
Today about a third of the states have laws regulating automobile-finance arrangements in some fashion, but, even so, a wide variation is possible. In approximate order of cost in interest, here are the principal methods of raising automobile money:



5-6%: Collateral bank loan, secured by stocks, bonds, savings-bank passbook, real estate, etc. Loans of this type are often repayable in lump sums at the end of the term. Even though the security is left with the bank, any income from it still goes to the owner.

7-10%: Bank loan secured by a mortgage on the new car itself. Banks have taken to quoting the rates on loans of this type in terms of dollars instead of interest rates (see box on page 11 on calculating interest).

7½-12%: Bank loan secured by your signature alone. To get money this way you have to have a good credit rating and a steady job.

11% and up: Conditional-sale contract with dealer, sold or discounted to a finance company, or other finance-company arrangement. The disadvantage of this type of financing is cost; the advantage is convenience, since everything is handled by the dealer. Also some finance companies, charging high rates, will accept risks no bank would touch.

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Typical Finance Charges

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$3,000	192.12	287.52	383.52	480.30	576.96
	266.01	182.64	140.98	116.01	99.36

"No down payment"

Banks and reliable finance companies require a down payment of roughly a third of the cost of a new car. When this isn't covered by the trade-in and the customer doesn't have the cash, dealers sometimes boost the car's price and the trade-in by the same amount till the trade-in, on paper at least, reaches the one-third point. This doesn't affect the cash difference, but it does mean that the buyer may go a long time before he owns even a hubcap of his own car.

"No down payment" ads are based on a switch. Instead of paying one-third out of his pocket, the buyer is conned into financing the down payment, too. Since regular

Buying on 36 payments? Here's how much of the car you own

finance companies will have no part of such deals, this has to be done through personal-loan firms, often with chattel mortgages. The cost of such financing may be as high as 35 to 50 percent a year, and a default can result in the buyer losing not only the car but his furniture as well.

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Picking your dealer

By the time you've visited three or four showrooms, you'll know not only what your car is going to cost but also who's who among the dealers. The sharpshooters naturally claim to be as honest as the next man, but they usually exhibit their practices for everyone who knows to see. The tips below will help protect you.

How to outwit sharpshooters .....

- Call up or visit customers who've bought cars recently from a dealer you're considering buying from. An honest dealer won't be afraid to give you names. Also ask your bank and local tradesmen about him. If you're in a big city, you might consult the Better Business Bureau, which probably has files on several dealers.
- Watch out for agencies that use wild advertising claims. "No down payments," "Name your own price," and other statements of that type are come-ons to draw in the suckers. So are "would-you-take" cards offering fantastic trade-in allowances, tucked in the doors or under the windshield wipers of parked cars.
- Be wary of the dealer who stresses the big trade-in or discount and won't talk cash difference. He's probably packing his price.
- Be careful when a man offers you a deal several hundred dollars better than anyone else around. A variation of $100 is reasonable, but a dealer has to have an awfully good reason to quote a net price $300 under his competitors'. Some dealers slip customers the "lowball" this way (see glossary on page 14). Signing a contract and paying a deposit are sometimes no protection against finding out, when you return to pick up your car, that the new-car price has suddenly risen and the trade-in offer dropped. Often this is in keeping with what it says in small print on the back of the contract.
- Don't let your registration or keys get away from you. Salesmen sometimes borrow them and turn them over to an "appraiser" who conveniently disappears for hours. Without them you can't drive away, and the pressure boys are experts at wearing a man down.
- The dealer who insists that you finance with his company is probably trying to protect a "participation discount." If that happens on insurance, he may have a hook in that, too.

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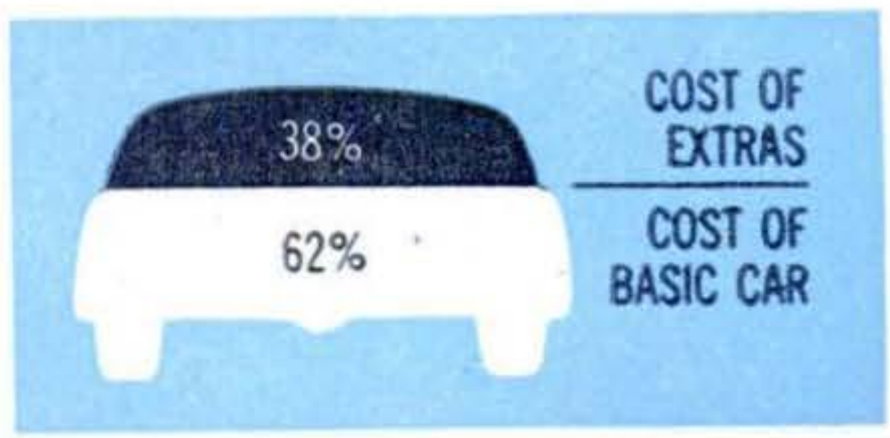
overhead can probably do even better. If you live in a big city, the big dealer with a good reputation may well be your man. But if you live in the suburbs or country, you may make a mistake to travel to the city to buy a new car. Although the manufacturer's guarantee is theoretically good at any dealer's in the country, there are exceptions. There is an unwritten understanding throughout the industry that, within a radius of 50 miles of the point of sale, only the dealer who actually sold the car has to honor the guarantee.

At any rate, you can be sure that your local dealer won't be overjoyed to have you bring him for warranty work a new car you went somewhere else to buy. One dealer told me he'd kept such a car on his back lot for two weeks before fixing it, ostensibly while he waited for special parts. The only thing against the small local agency is that it may not be able to afford all the tools and trained mechanics to service as complicated a machine as some modern cars are. If it can't do the job, it may be forced to send it to a larger agency.

Options and extras

Most dealers carry a considerable stock of cars—a suburban dealer might have 25 or 30 on hand, a city dealer two or three times that many. Usually they have a wide variety of models, engines and transmissions. Obviously these basic factors can't be changed, but the accessories can.

Because dealers make proportionately twice as much on extras as on cars, they like to sell you the works, but most won't push too hard. So you can pick and choose what you want, expecting to wait no more than three weeks for a model not in stock, only a day or so for accessory changes. The heater that's designed for a car is usually a good thing to have, but such gadgets as radios, outside mirrors, etc., can generally be bought cheaper from mail-order houses, auto-supply stores or even junk yards.



Buy "the works" and this happens

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and make-ready." But, if inclined, the dealer can pocket this money by skimping on service.

When you shop, be prepared to do some traveling. Outside of big cities, dealers selling the same make are usually located miles apart. Take a pad and pencil with you to record model numbers, options and other details to be sure your prices are comparable.

There's only one price that should count, and that's the "cash difference," the net cost to you after any discount or trade-in is figured.The buyer who looks only for a big trade-in is fooling himself. By merely boosting the delivered price of the new car, a dealer can offer almost any size of allowance he wants. This is one of the oldest and commonest tricks in the business. Of course, the suggested retail price allows the dealer some room to move around. It's not uncommon to get discounts of a few hundred dollars or trade-ins a few hundred above the Blue Book value.

Bargaining pointers

You'll find that net-cost figures tend to stay pretty much in line. In many areas, dealers selling the same makes have informal agreements so they don't compete too actively. Anyway, the cost of a new car to the dealers doesn't vary. Even the high-volume man pays about as much as the small agency. A difference of $50 between two dealers' prices shouldn't matter much. Not that $50 isn't important money; it's possible, though, to lose a lot more when trying to save that amount.

You can, of course, always make a pitch to persuade the dealer you want to buy from to lower his price. But be honest with him. Dealers are used to bargaining, and the phony tales of low offers from some other agency are endlessly repeated refrains in their ears. A good dealer, who won't be fooled by such tactics, might shave his figure a bit for a man he knows is serious.

Geography is a factor in price and service. Sometimes big-volume dealers can actually cut the price a little by spreading their overhead. The one-man, country-crossroads operation with hardly any service department or

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a guarantee. About all you can do is shine her up a bit and advertise in the papers.

Of course, if a friend wants her and will pay your price, you're set. Or you might try making an arrangement with a local gas station to leave the car there with a sign on it and pay the operator a small commission. Sometimes even new- or used-car dealers will show your car to customers for a five-percent commission. This method might be worth a try, but don't get yourself stuck without a car and have to buy a new one in a hurry. Haste can be expensive.

Be a shopper

Whether or not you know what make and model you want, you'd do well to go on a shopping tour. Dealers dislike shoppers, but there's no other simple way to learn so much. In the first place, although cars are standardized, prices aren't. There are suggested Detroit retail prices, but these are pretty much hidden from customers nowadays. Try calling GM, for instance, and asking for some figures. You'll be referred smack back to the dealers, who set the prices they think they can get.

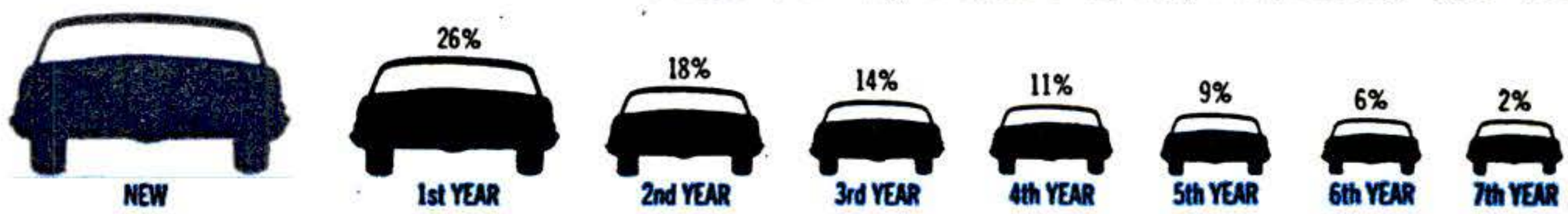
So without doing some shopping, you're buying in the dark. In the course of your tour, you'll also get a chance to size up dealers. The choice of a dealer is important, because you're getting a lot more than just a load of metal, cloth and plastic. Today's car is a mechanical marvel that would have given a production engineer nightmares 25 years ago. It's true that most new cars leave the end of the production line under their own power, but before you'd be satisfied with them they need a lot of tuning and adjustment. That's the dealer's job, and you pay him for it. The factory sends him a check list of around 50 items he's supposed to take care of before delivery. These range all the way from putting in floor mats and polishing chrome to making mechanical adjustments. The cost of this work is included in your bill; it may even be listed separately as "handling

Cash difference stays the same

When to buy

Before you even visit a showroom, you've got to decide what kind of a buyer you want to be, a two- or three-year trader or a man who drives his car until it's about ready to drop. When to buy may depend on this. The prices of new cars vary with the season. Right after the new models are released, you have to pay full value for the privilege of showing off in one. Later, when the novelty has worn off and the weather is still at its winter worst, the price falls a little. In spring, during the buying rush, it's usually up again. As summer comes in and the end of the model year approaches, it plummets. After the new models come out, the leftovers have to be sold at cut prices.

A new car depreciates at approximately this rate



For the short-term trader, there's no particular advantage to buying at any special time so long as he's consistent about trading at the same season. If you buy at the end of the model year and trade a couple of years later at the beginning, you'll lose on the trade most or all of what you gained in the purchase. If you stick with your car until it's old and rattly, a year-end deal is worth while. Then, by the time you trade again, the difference of a single year in the car's age won't much matter.

To trade or not?

The next decision to make is whether to trade your old car or go for a clean deal. If you've got to unload the old baby anyway, it's simplest to trade. Otherwise you've got to enter the used-car business. Here you're handicapped: You can't attract the prospects a dealer can; you can't arrange financing; and you're hardly in a position to give

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tremendous bargain is a four-sided, straw-chewing dumbbell. Despite all the boasting about rake-offs and fantastic trade-ins, authorized new-car dealers usually make good money—and they make most of it selling new cars rather than on their service departments. If they didn't, they wouldn't stay in business long.

Buyers' greediness is the basis for many of the rackets in the game. The schemes often start with the premise that the customer can't refuse an incredibly high trade-in allowance or discount. This is used to blind him to what he's really paying. In some variations of the theme, the first overwhelming offer by a salesman is thrown out by higher authority (the sales manager or agency owner). A see-saw act of offers and withdrawals follows, which is intended to bewilder the customer into saying yes. The giveaways in this business are generally mirages.

Another cause of much difficulty is the split attitude most customers have toward auto dealers. They suspect them of skulduggery during price negotiations. Once a satisfactory figure is agreed on, however, they treat dealers like brothers, trusting them completely. Several states have had to pass laws to protect customers from their own naiveté. Thousands were signing blank contracts on the word of salesmen and complaining afterward that the details filled in later didn't agree with the promises.

Nothing should be taken on faith in buying a car—or in any other business dealing with a relative stranger, for that matter. Get everything down on paper, and remember you have complete freedom of maneuver.

You don't have to . . .

- Buy a car you don't want
- Finance it any way you don't like
- Take insurance with a company you don't care about
- Take extras you aren't interested in

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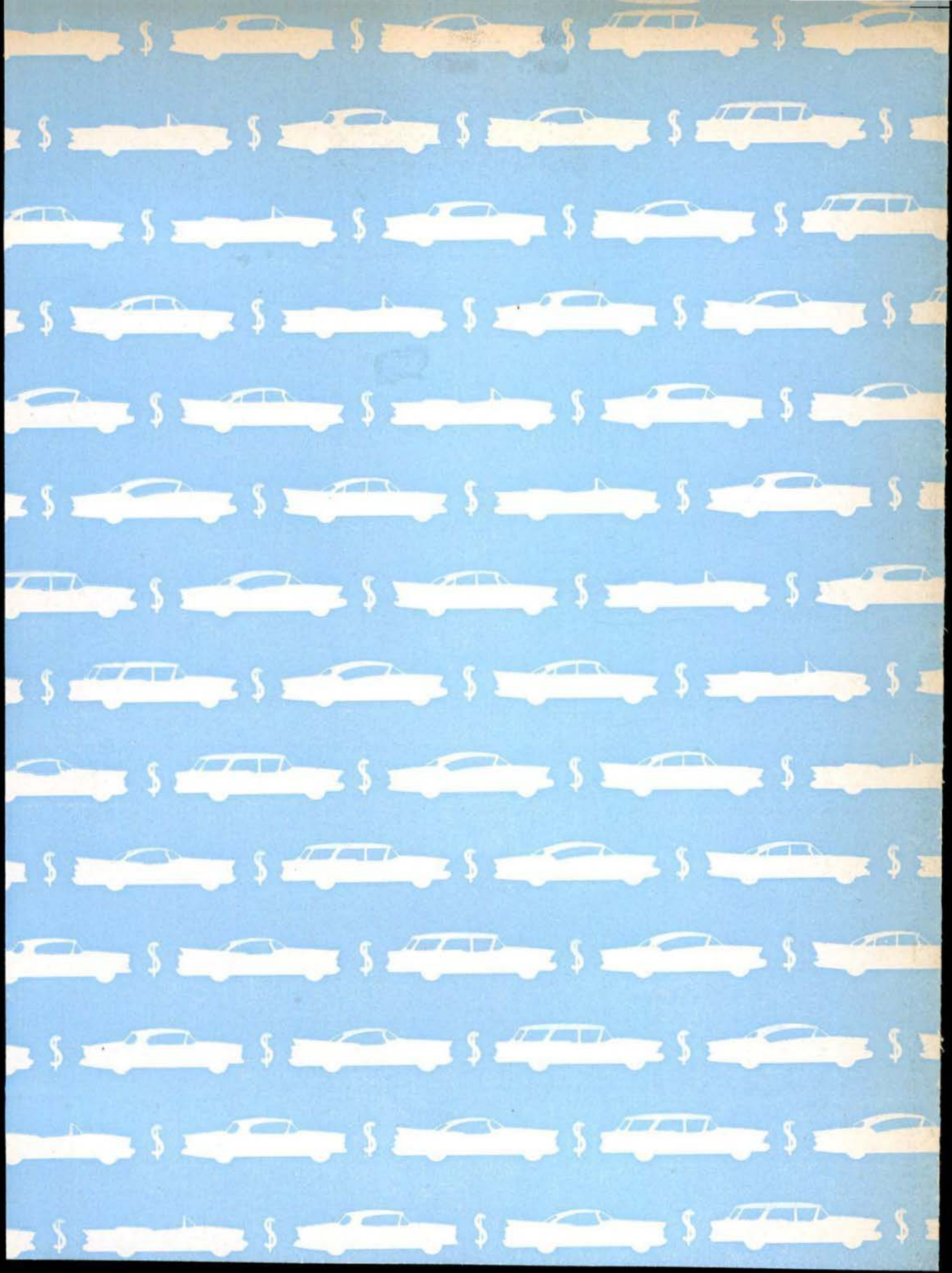

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Use This Check List When You Shop

Dealer's Name				
Model and Number				
Transmission and Other Options				
Accessories				
Delivered Price				
Trade-In				
Cash Difference				
Total to Be Financed				
Total Finance Charges				
Monthly Payments				

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Foreword . . .

ONE of the most complex business transactions in many people's lives is the purchase of a new car. Usually it's four transactions rolled into one: selling an old car, floating a substantial loan, taking out insurance, and finally buying the shiny new cause of all the commotion.

Normally these are all handled at one fell swoop by the dealer, who, if he's so inclined, has a choice of ways to chisel. Most dealers don't chisel, and the Better Business Bureaus of the country get on the trail of the minority of dealers who do.

Like rainy days, though, sharp dealers will always be with us in some numbers, and they can cost an unsuspecting buyer several hundred dollars. In addition, it's easy to spend too much merely through ignorance without any dishonesty being involved. You can, for example, pay more than necessary for a loan or go wrong on insurance.

One of the most confusing elements in buying a car is the widespread belief that the customer who doesn't get a

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No. 2

POPULAR SCIENCE REFERENCE LIBRARY

How to Buy a New Car

. . . this practical guide tells you how to get the best deal

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Picture News
IN THE WORLD OF SCIENCE

Atomic energy vulcanizes tire, gives it longer wear

HERE, for the first time, an auto tire is vulcanized by nuclear radiation. Protected by 17 feet of water, B. F. Goodrich scientists check gamma rays with ion chambers as the steel-encased tire is rotated over radioactive elements from a reactor. The process, still undergoing tests, may give longer-lasting rubber. The tires retain no deadly rays.

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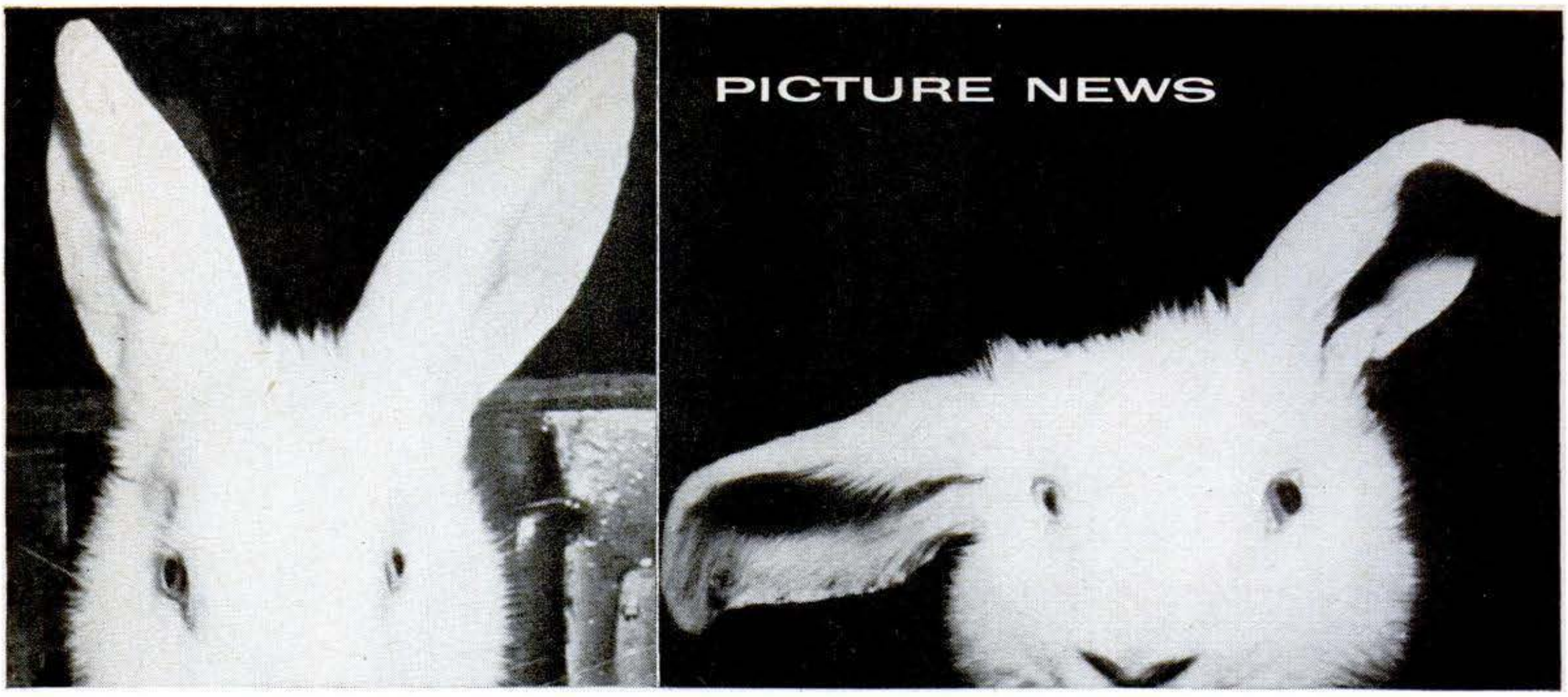
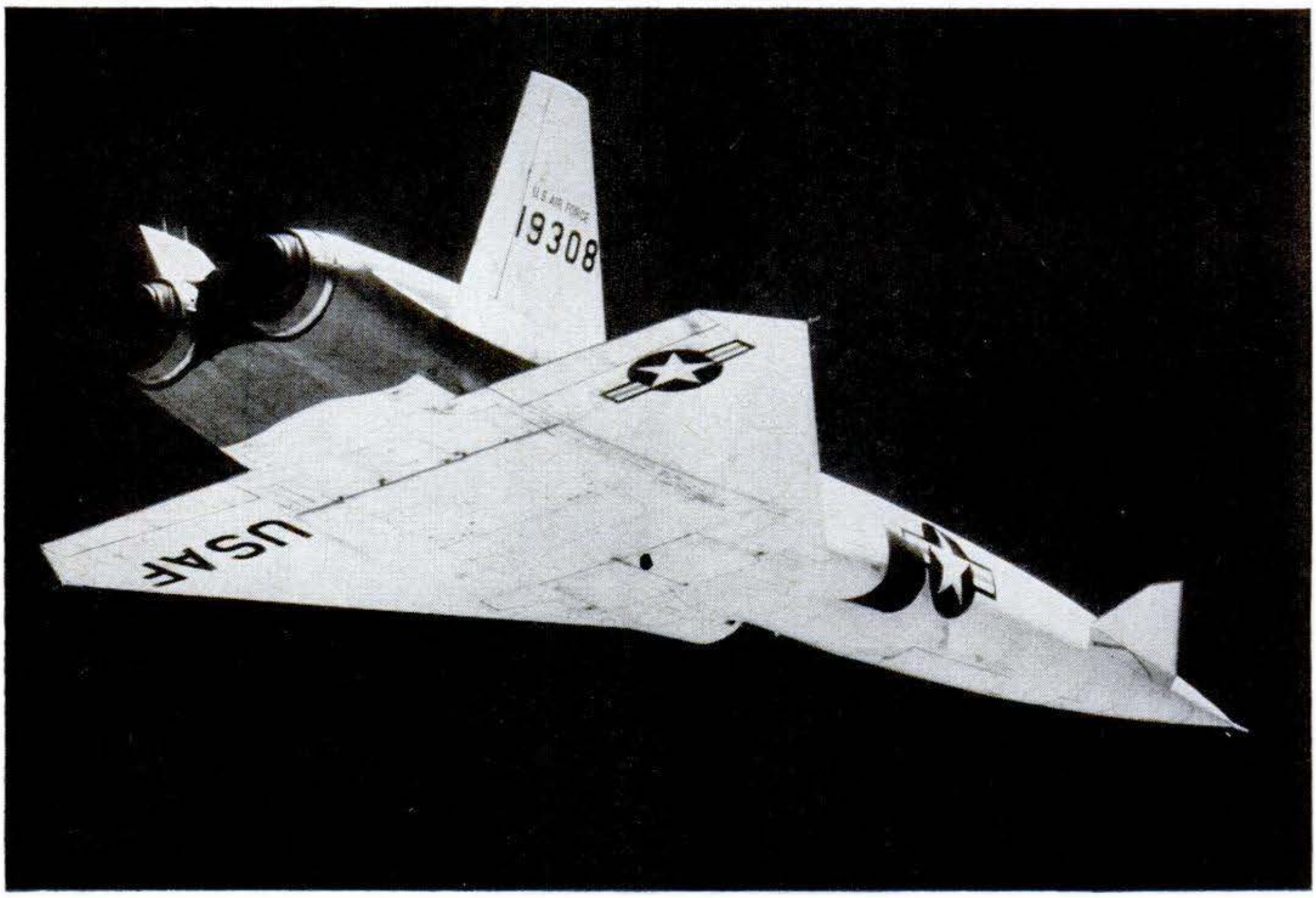


Enzyme injection accidentally wilts a rabbit's ears

THIS droopy-eared rabbit came up with its surprising performance during research into the origin of rheumatic fever. Normally perky, as at left, it was injected at the New York University College of Medicine with an enzyme used to tenderize meat. Its ears began to sag, then



Supersonic jet-powered missile has wings like plane

A NEW weapon in the Air Force's intercontinental guided-missile program, the X-10 Navaho is shown here in a flight test. It has stub wings and rudders instead of fins. After rocket takeoff, two ramjets push the North American Aviation vehicle to high altitudes and supersonic speed.

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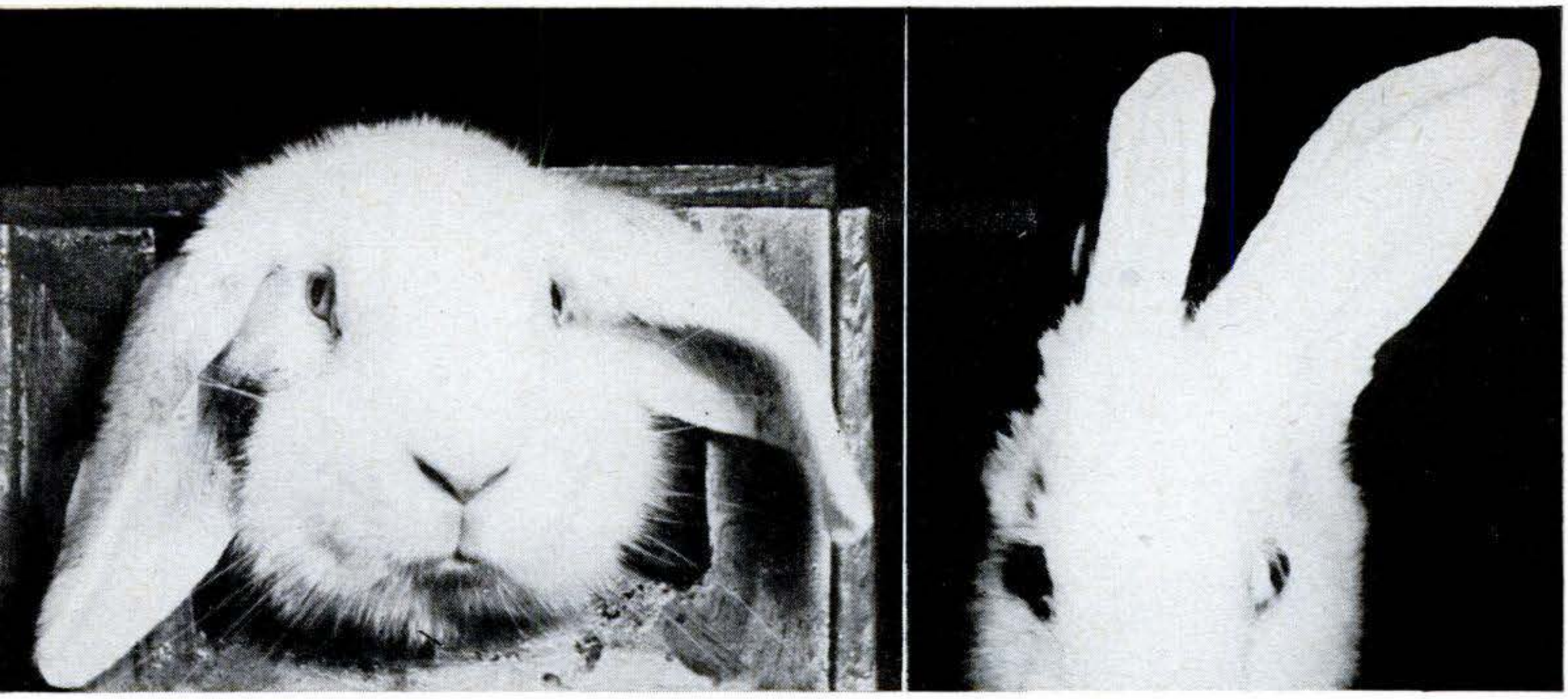
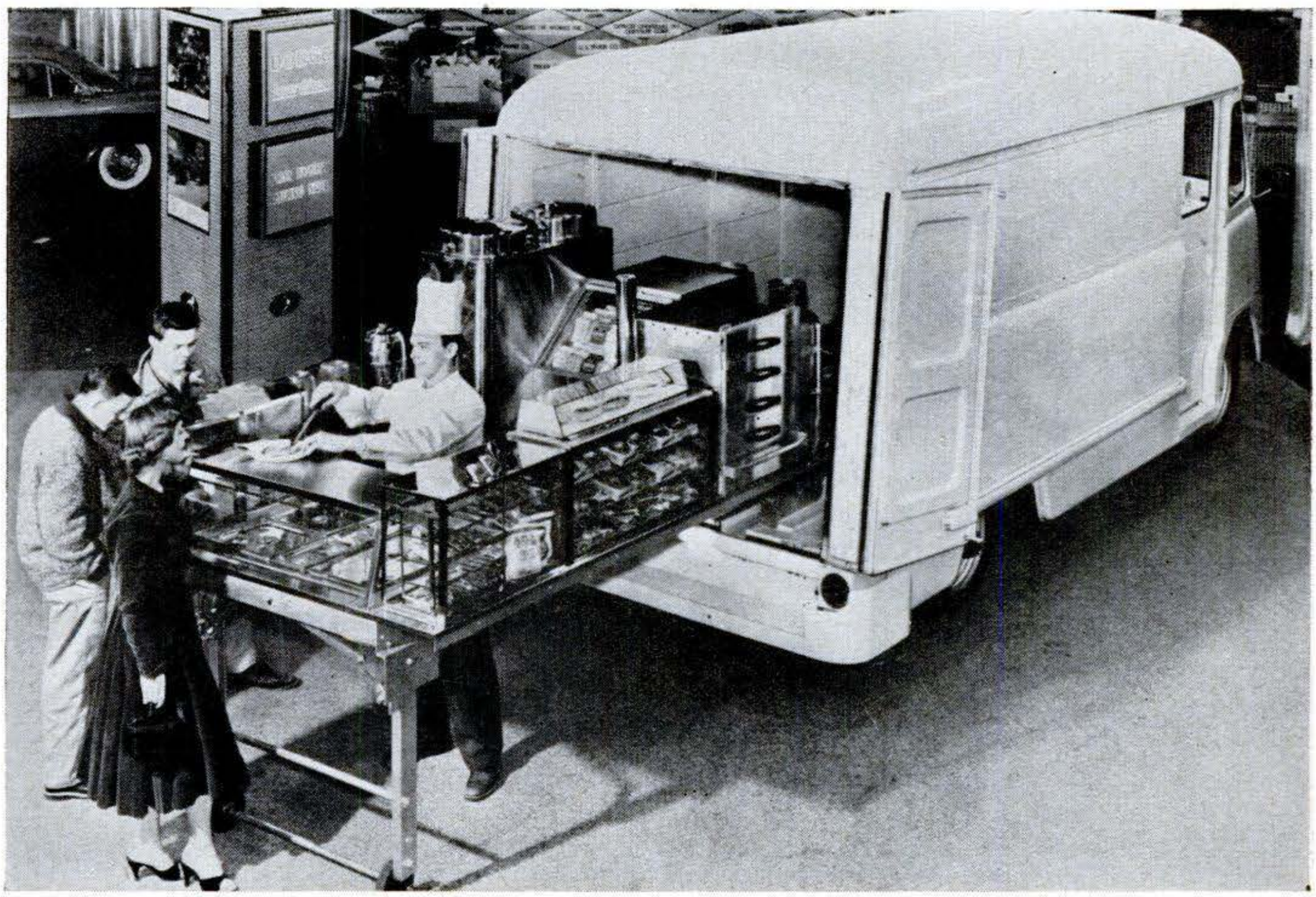


flopped completely as the injection took hold. A few days later (right), they were back to normal as the effects wore off. Dr. Lewis Thomas, professor of pathology, who conducted the work for the New York Heart Association, believes the unexpected results may show a link between physical shock and the effects on the body of bacterial poisons.



Quick-lunch wagon is ready to serve in 40 seconds

PUSH buttons slide out the food unit of this Dodge-built mobile cafeteria, which can be ready for mass serving of hot meals 40 seconds after parking. On the unit are an oven, steam table, coffee urns and refrigerator. The wheeled supports drop down like a plane's landing gear.

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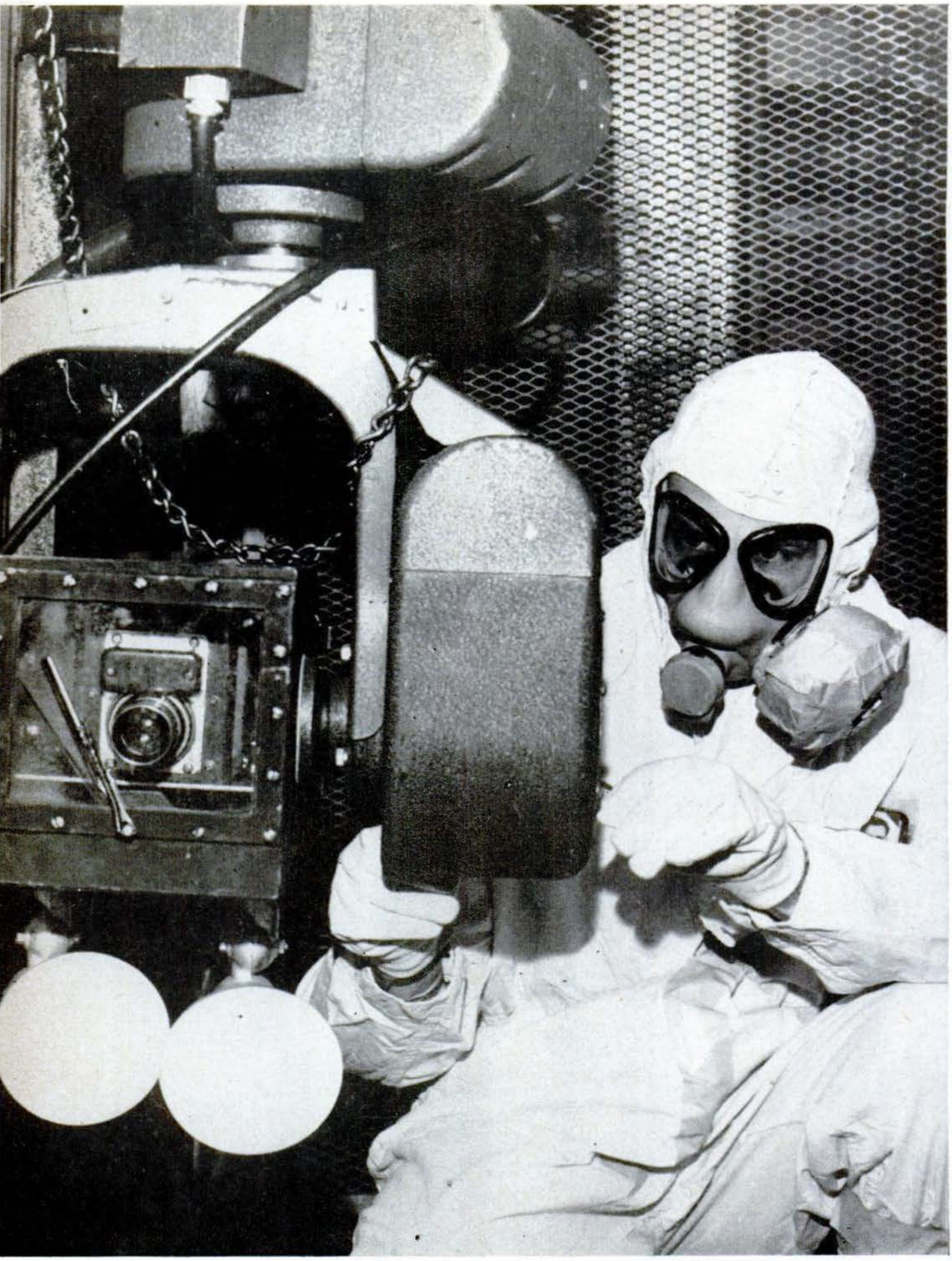

TV camera keeps an eye on atomic reactor at work

EQUIPPED with two powerful floodlights and a windshield wiper to keep its "eye" clear, this specially designed TV camera rides a rail to monitor operations of a reactor at the Hanford, Wash., atomic plant. Its closed-circuit pictures go to an operator behind radiation shielding.

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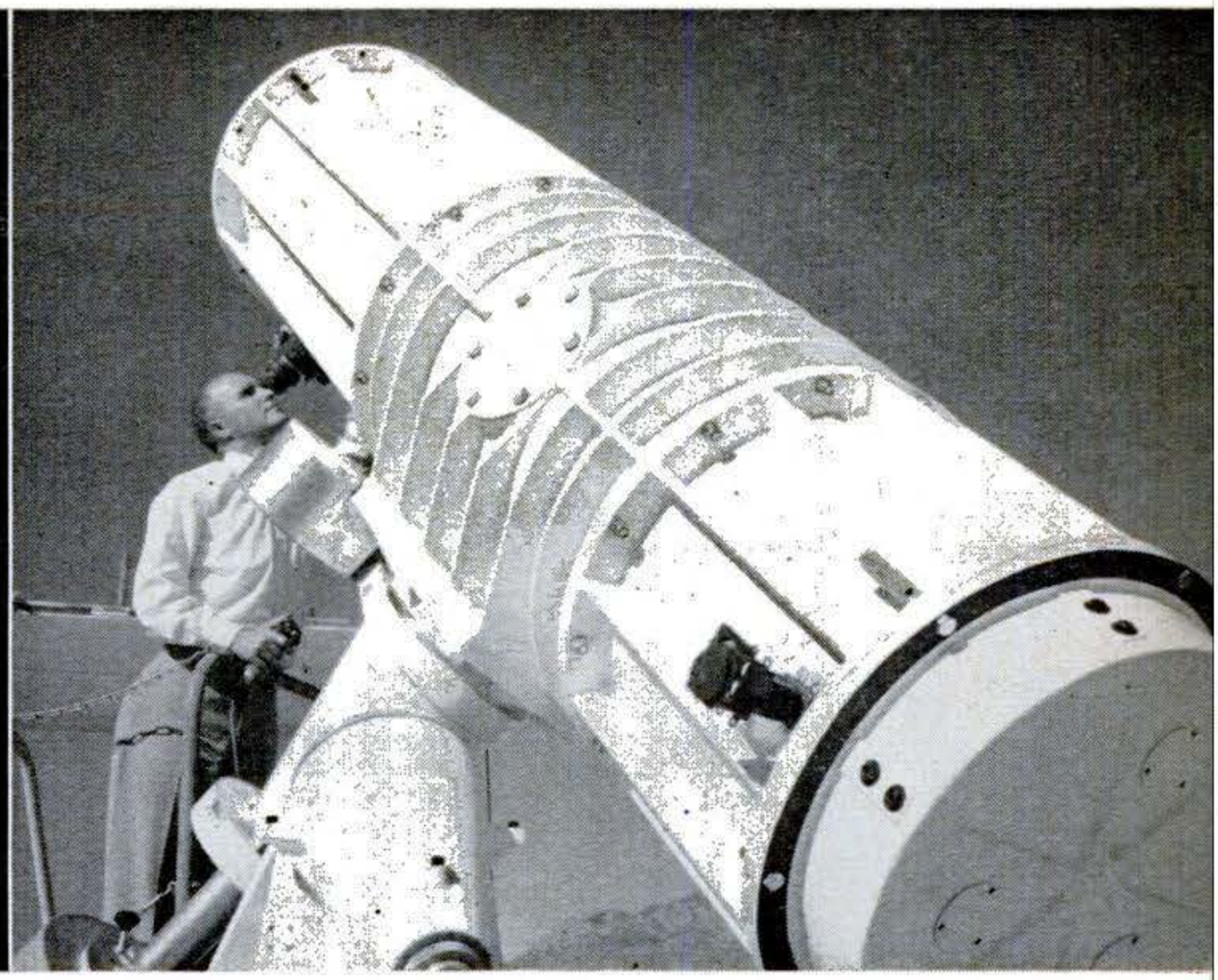
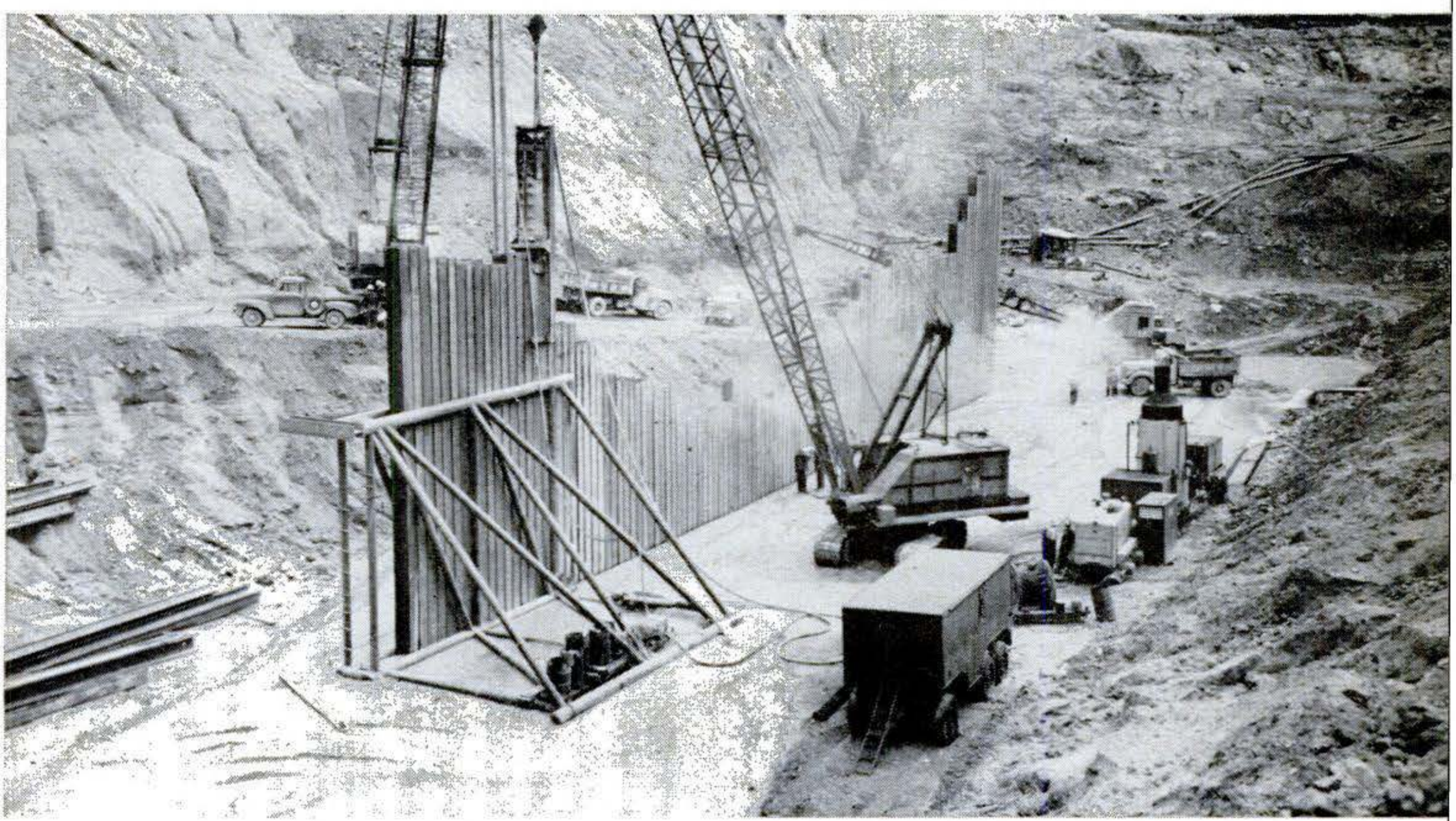


Tracking unit snaps clear shot of jet 40,000 feet up

USING a record 24-inch fused-quartz mirror in its optical system, this telescopic camera caught sharp details of an F-80 jet (left) at an altitude of 40,000 feet. The instrument, built for the AEC at Albuquerque, N. M., has a 10-foot focal length and magnifies up to 1,200 diameters.



Steel curtain to guard big Oregon dam against seepage

A 300-FOOT wall of interlocking wide-flange I beams will prevent seepage at the bottom of the Lewis River Canyon dam. Here a tubular guide holds pilings in place as they are driven to bedrock. Cells inside beams will be filled with concrete, and a block of concrete will encase the wall.

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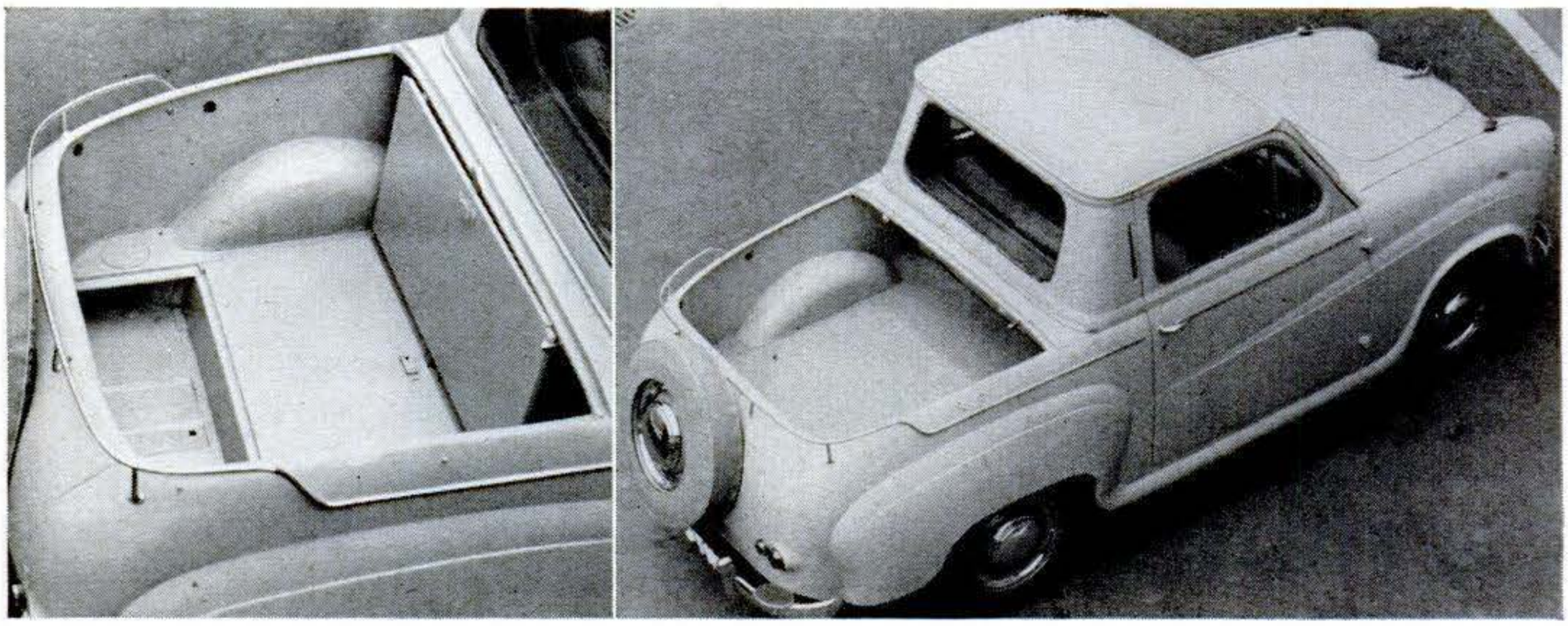
Hitchhiking missile gets air launch to target

HERE the Air Force's death-dealing Rascal hurtles toward a target after its launching from the B-47 above it. The rocket-powered guided missile has a reported 100-mile range. Air-lifted to a safe distance from enemy installations, it rockets at 1½ times the speed of sound to its target without exposing the plane to concentrated defense weapons.



Bed of pickup truck converts to rumble seat

PULL up the sliding floor on this 32-hp. quarter-ton Austin pickup and it becomes a rumble seat (left). Passengers would face the rear and tuck their feet in the well. A flat-fitting fabric snaps on to cover the cargo area of the truck, built primarily for small business firms.

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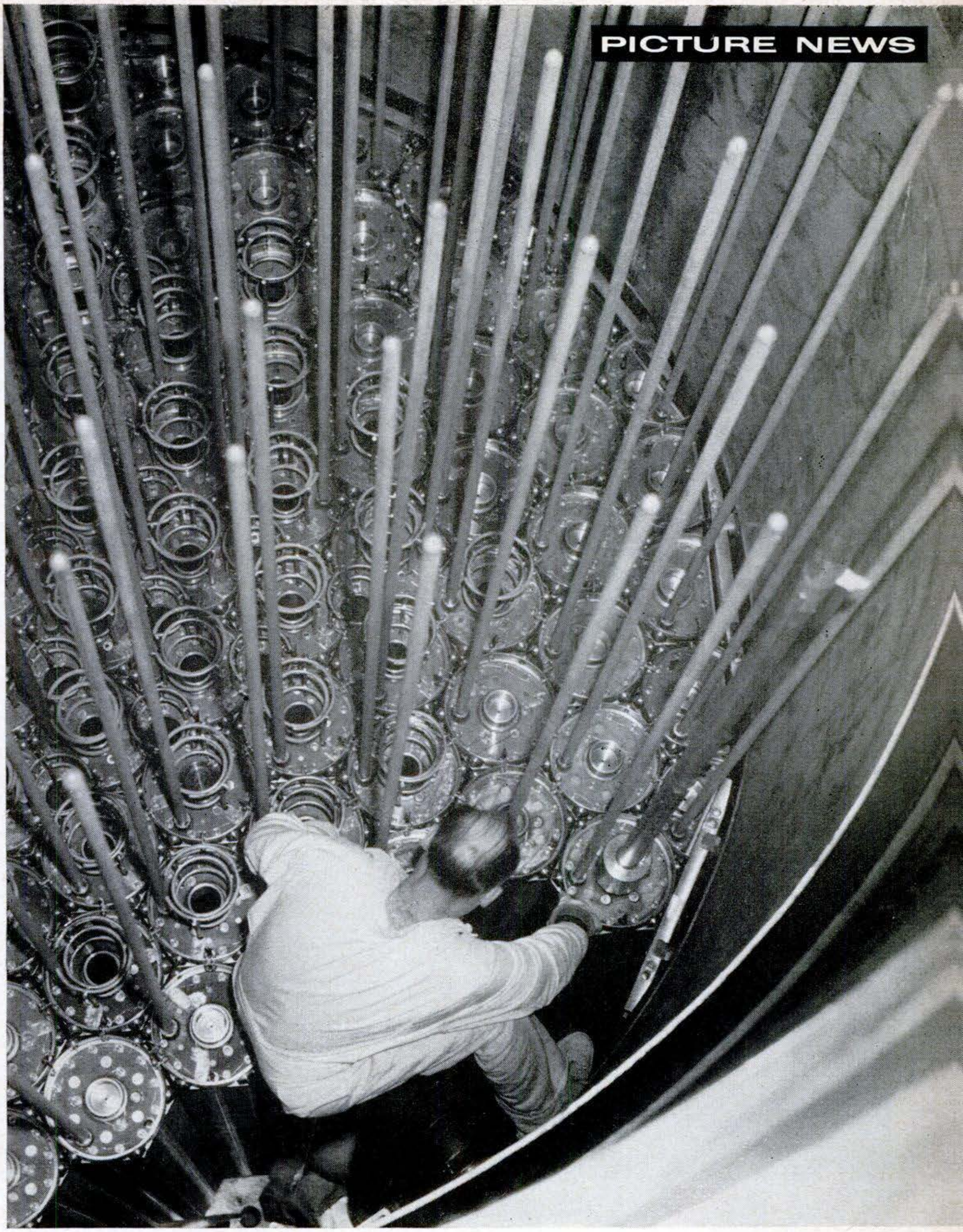

Camera probes heart of a reactor-in-the making

THIS photo lets you peek into the core of a sodium reactor that will run a pilot power plant near Los Angeles. Nuclear heat will generate electricity in an experimental program to obtain economical power from atomic energy. The heat-transfer agent will be liquid sodium.

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FLAGSTAFF

SPOTLIGHT

HANDHOLD

CAT'S WHISKER

RUNNING BOARD

Running boards? Ike has 'em

THESE Presidential parade cars include one feature that contrasts sharply with their modern design: running boards. They provide standing room for President Eisenhower's Secret Service bodyguards.

The custom-built Cadillac convertibles also have fire-engine-type rear steps and handholds, flagstaffs with nighttime illumination, and "cat's whiskers" to judge the width of narrow passages.

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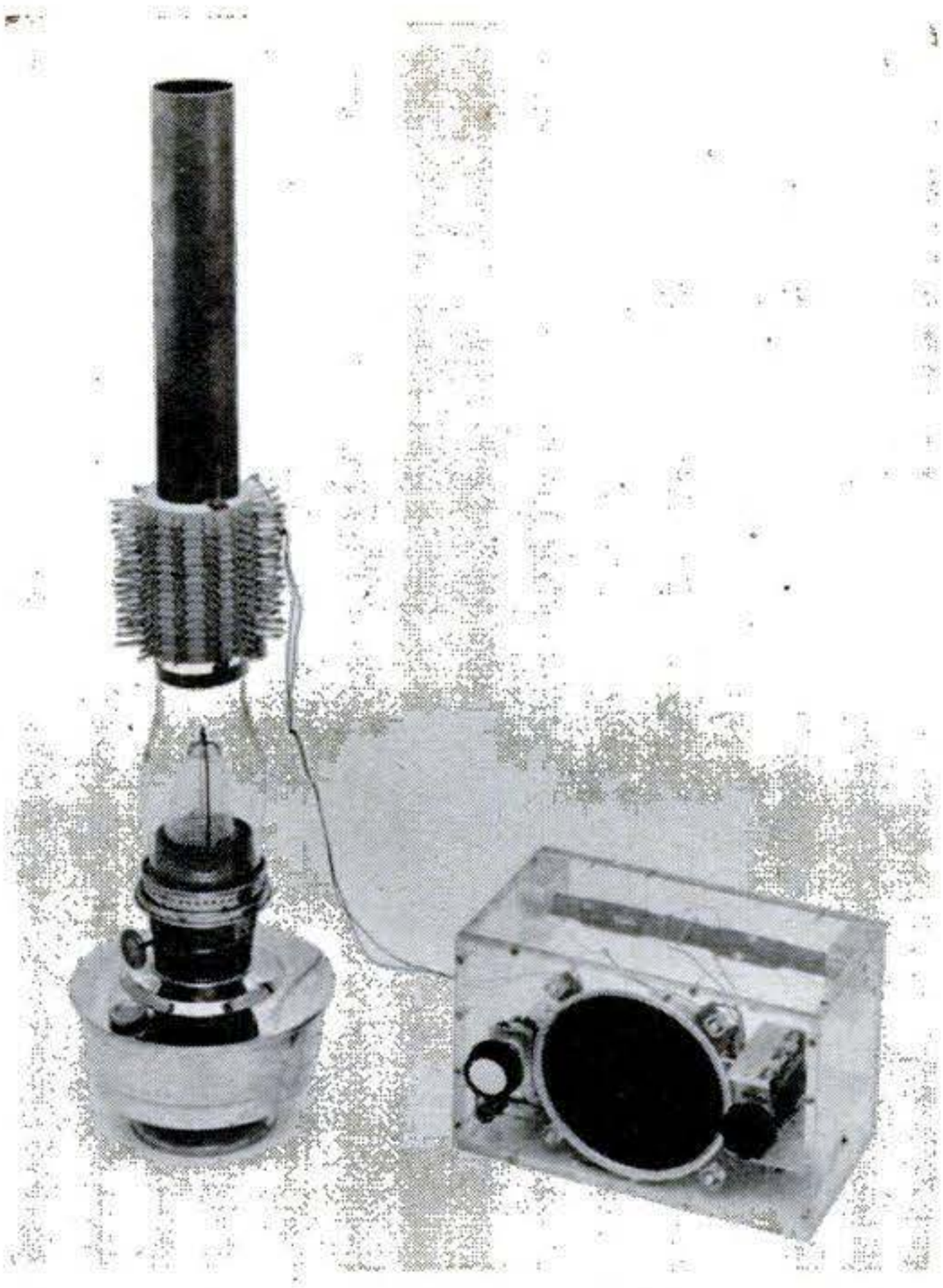

Kerosene lamp powers radio

WITH a thermopile—a device that turns heat into electricity—on its chimney, this oil lamp runs the transistor radio beside it. Philips Research Laboratories in Eindhoven, Holland, is testing the method.

Tent sleeps two on top of car

RAISING the aluminum roof by winch erects this two-man British tent in less than a minute. Collapsed, it is a 16-inch-high car-top box that holds the bedding. The ladder folds to tuck under it.

Now medic can breathe for two

THIS mask-to-mask hookup lets the Army medic below give artificial respiration during gas attack. Inhaling draws purified air from the canister; exhaling pumps part of it to the casualty's lungs.

Noise meter records traffic din

WITH the help of a microphone and this meter, motorists in West Germany's large cities will soon be able to check the noise of their own motors and exhausts. It is part of a campaign for quieter traffic.

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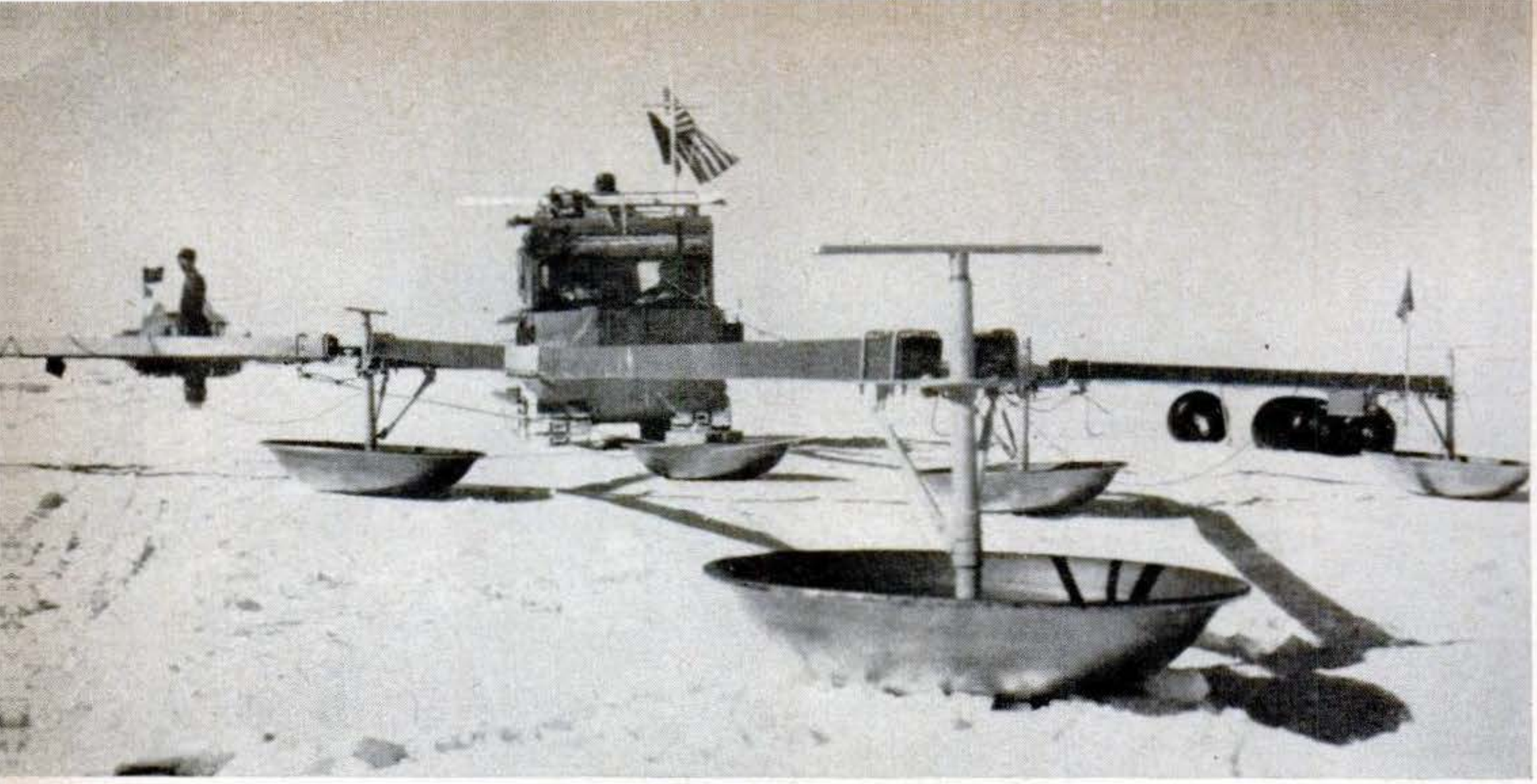

Outrigger "dishpans" warn of hidden polar crevasses

A NAVY Weasel starts here on a 600-mile trail-blazing trip across antarctic ice and snow to little-explored Marie Byrd Land. The dishpan-like devices out in front and to the sides are detectors that locate hidden crevasses—to keep vehicle and following equipment from dropping in.

Pint-size inflatable raft will keep baby afloat

WHEN a plane is ditched, the tiny, watertight British raft below is lowered to the water or strapped to an adult's back. It has buoyancy chambers, inflatable arches, ventilation valves, transparent hood, and insulated floor. The large raft, similar in design, holds six persons.

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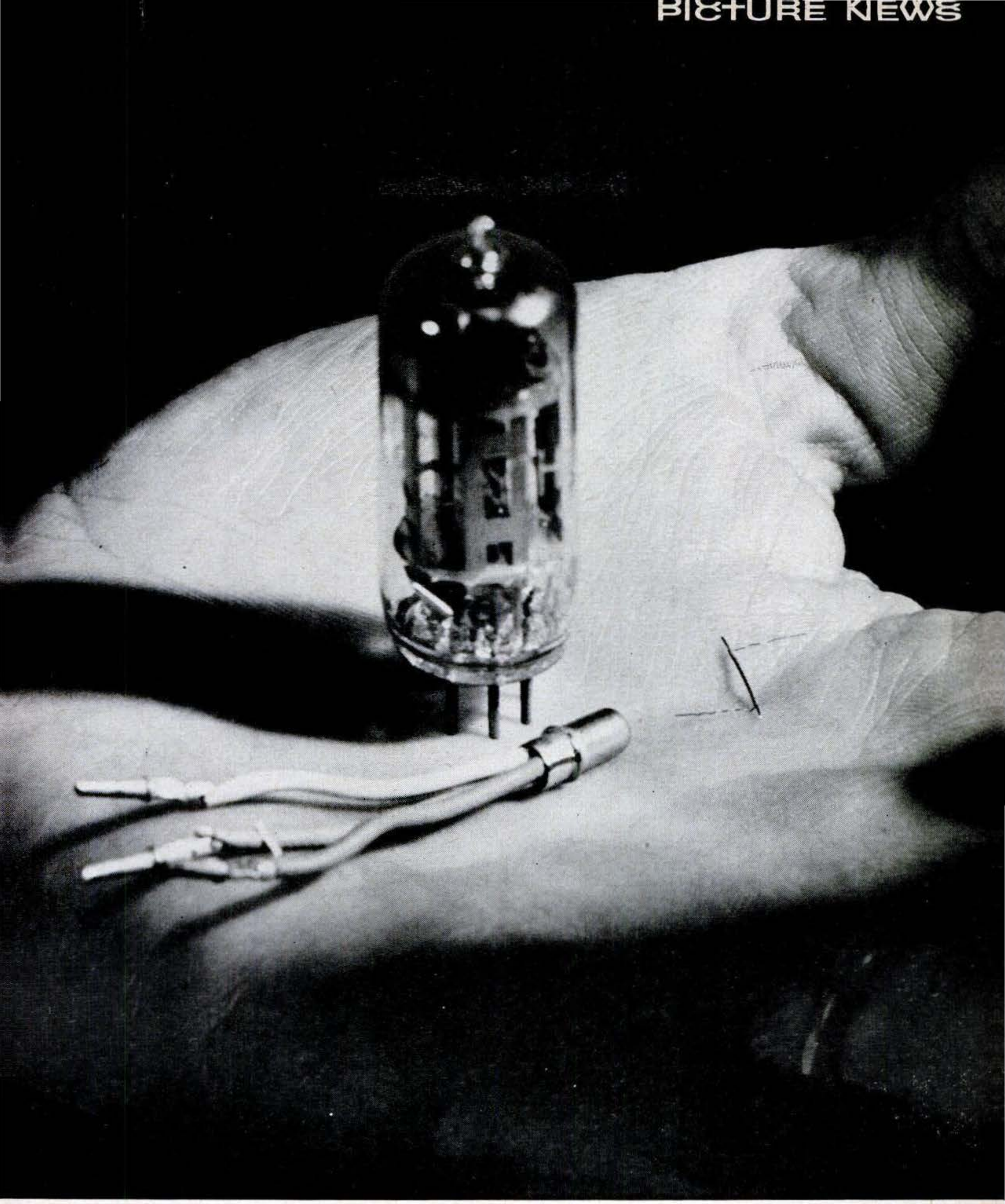

Supercooled wires do the work of transistors

So SMALL that 100 can fit in a thimble, M.I.T.'s new cryotron is shown (enlarged) beside a tube and transistor it may replace, to reduce the size of computers. It is the first practical use of superconductivity—the ability of some metals to conduct electricity with no resistance under extreme cold. The cryotron works in liquid helium at minus 420° F.

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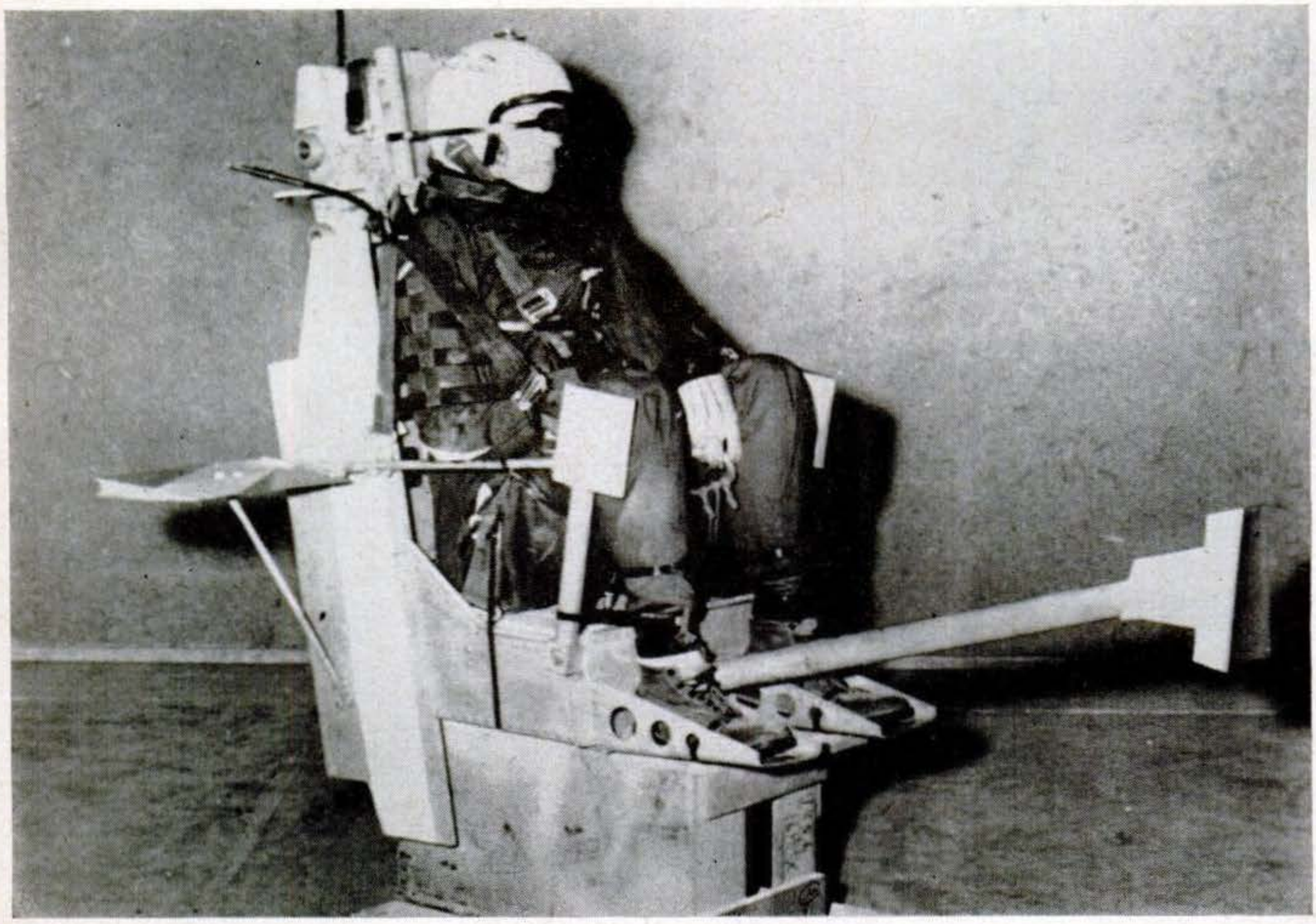
Closed-circuit TV lets passenger choose train space

ONE of 101 TV receivers in a huge closed-circuit network installed in New York's Penn Station, the screen on the counter above shows a passenger instantly a chart of available space on any train. With other electronic devices, including ticket printers, it helps to issue a ticket in two minutes. The network includes 170 miles of wire and 105 TV cameras.



Winged seat to eject pilot safely at supersonic speeds

FOR the safe escape of pilots traveling at more than 1,500 m.p.h., this Lockheed-developed ejection seat is being tested on an Air Force rocket sled. It has stub wings, vertical back fins and an automatic chute. The device out front (like a bug deflector on a car) deflects the wind.

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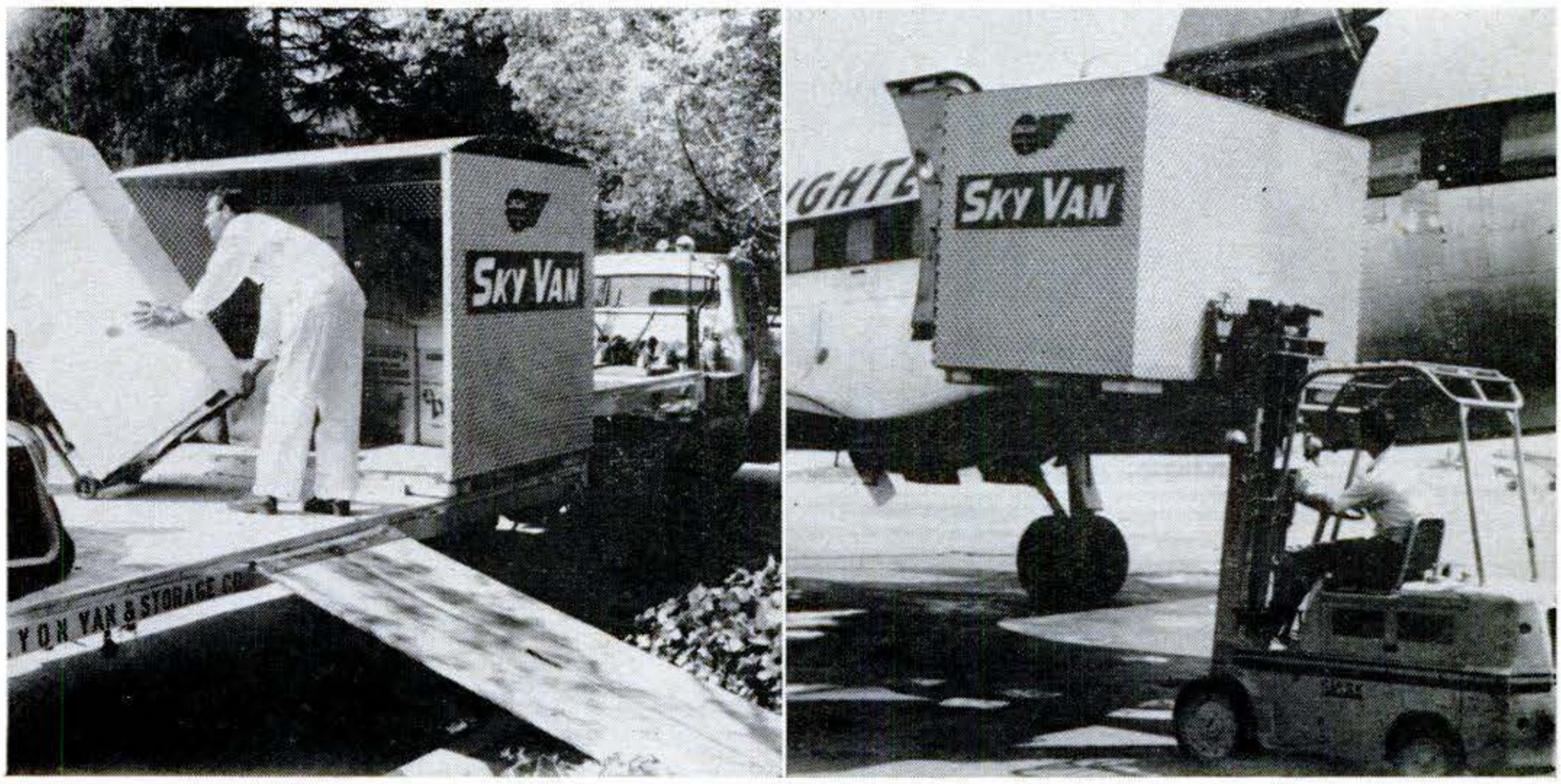
New rescue ship carries motor lifeboat piggyback

RUSHING to a rescue scene at 20 knots, the 52-ton Theodor Heuss, first of seven such craft for the German North Sea coast, dips its stern to launch or take on a motor lifeboat which can maneuver close to survivors.



Furniture packing cases convert plane to moving van

THESE new aluminum containers, packed with household goods and loaded on a plane, cut long-distance moving time—from two weeks to less than five days coast to coast. Four of the Sky Vans, each 5 by 5½ by 8 feet, hold 6,000 pounds, about all the furniture of an average family.

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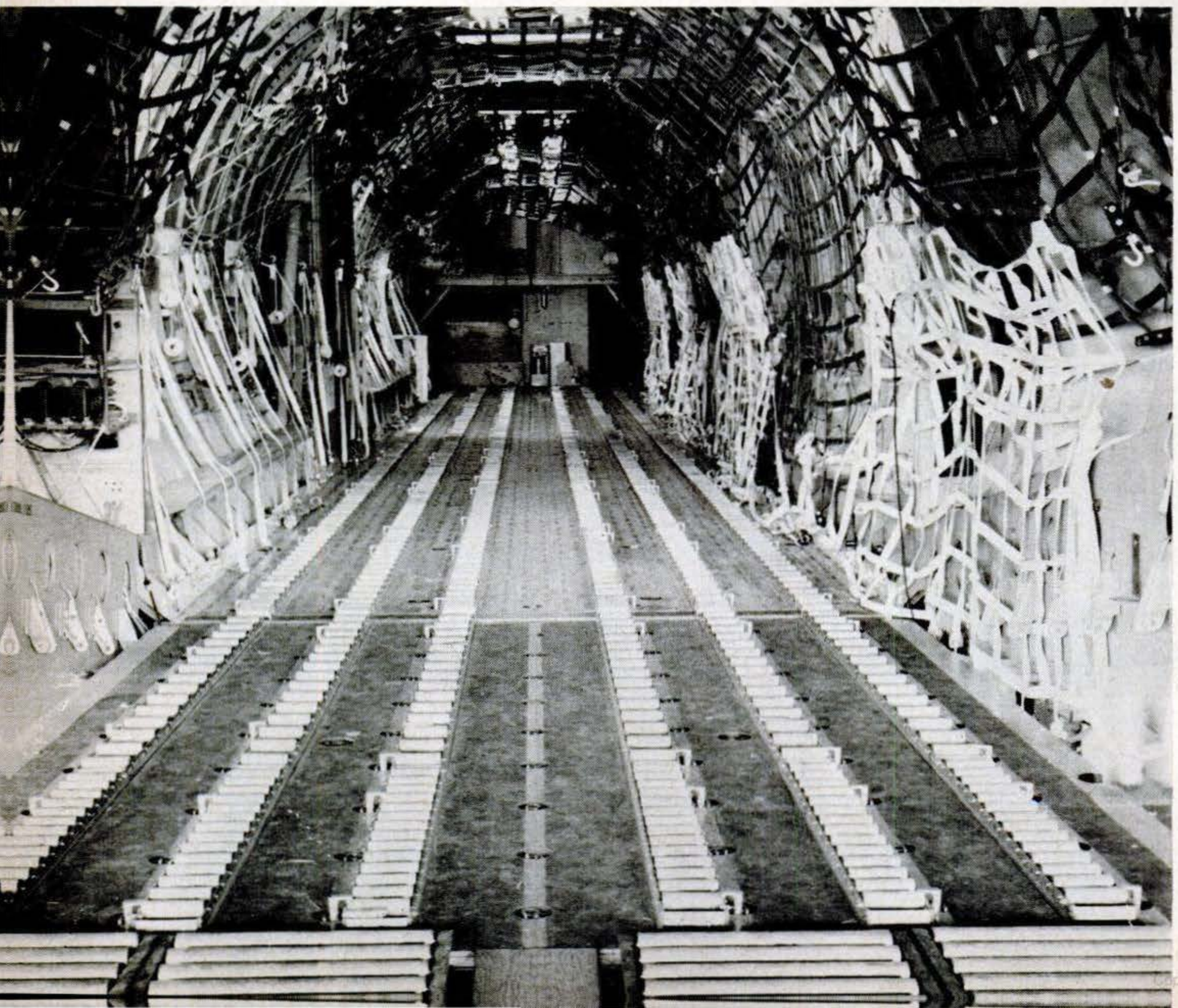
Russians put automatic transmission in 1957 model

NEWEST version of the Soviet Volga, this four-door sedan has a torque-converter automatic drive. Its 70-hp. engine gives it an 80-m.p.h. top speed. Body-chassis construction is integral, like the U.S. Rambler's.

Built-in roller conveyor speeds loading of big planes

A CONVEYOR system on the floor distributes a normal 68,000-pound load in the Air Force's giant Douglas C-133A in a fraction of the time taken by conventional methods. Cargo moves in from other conveyors on the dock. The webbing network is dropped on it and tied down.



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Hydraulic lift tilts truck and trailer to dump load

TIME and labor are saved when both truck and trailer are backed onto this platform and unloaded in one big tilt. The Crossett Co. uses the big hydraulic dumper to pour huge loads of chips into the hopper at its Crossett, Ark., paper mill. The machine tilts up to a 50-degree angle.

Supersonic Starfighter has "twin" with dual cockpit

A DUPLICATE of the Lockheed F-104A, world's fastest fighter (PS, June '56), except for two seats instead of one, the F-104B also flies at twice the speed of sound. It will be both a fighter and combat trainer.

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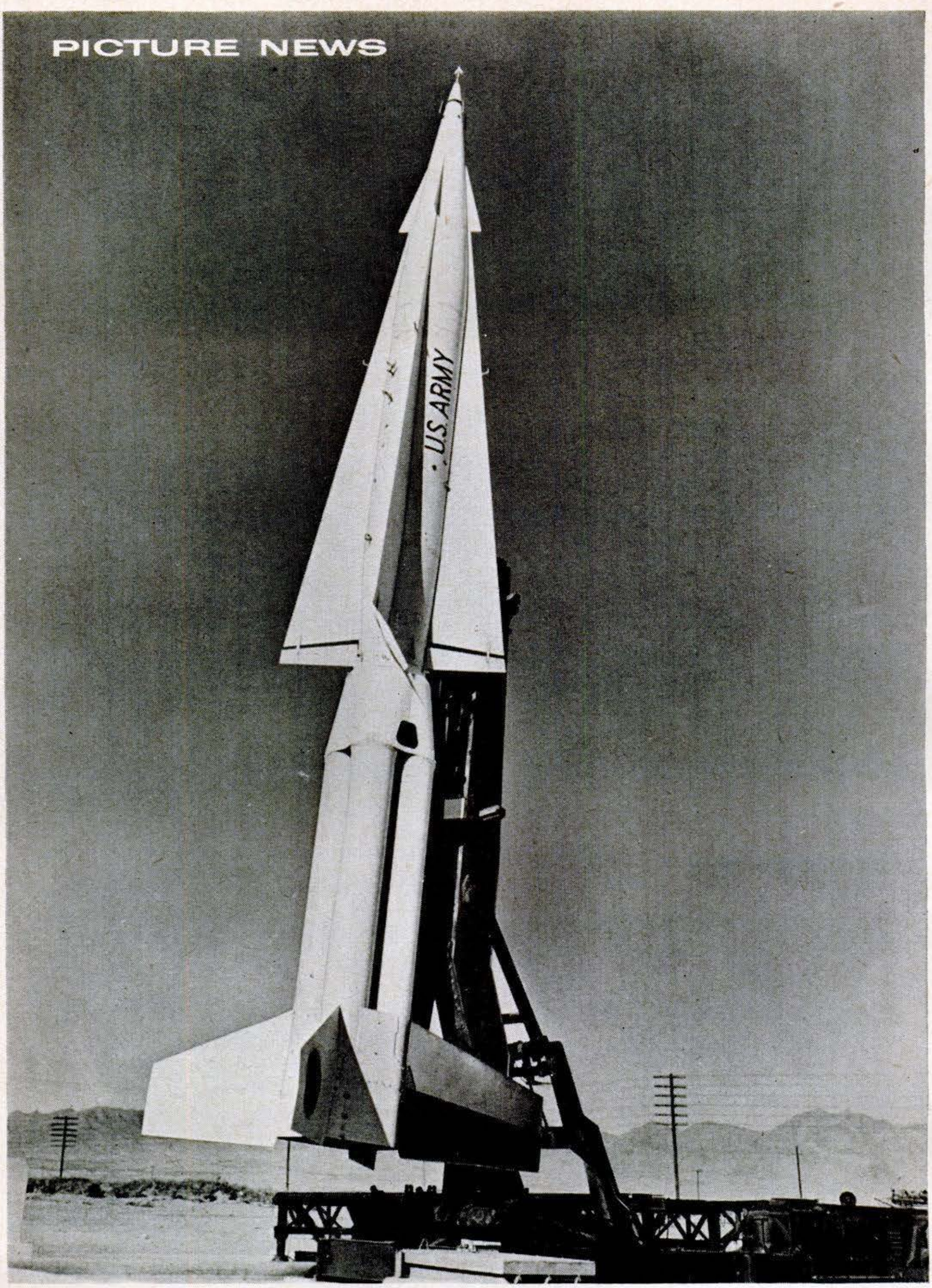

New Nike, bigger and faster, packs atomic punch

THIS first photo of the newest version of the Nike, one of the main U. S. continental antiaircraft guided missiles, shows its massiveness and long flying fins. Called the Nike Hercules—the original is the Nike Ajax—it is swifter and has greater range to protect key cities from the most advanced bombers. It is designed to carry an atomic warhead.

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What Will You Die Of?

Statistically, the answer depends partly on how long you live. Medical progress and new hazards are bringing surprising changes in the patterns of death.

By Guy Shipler Jr.

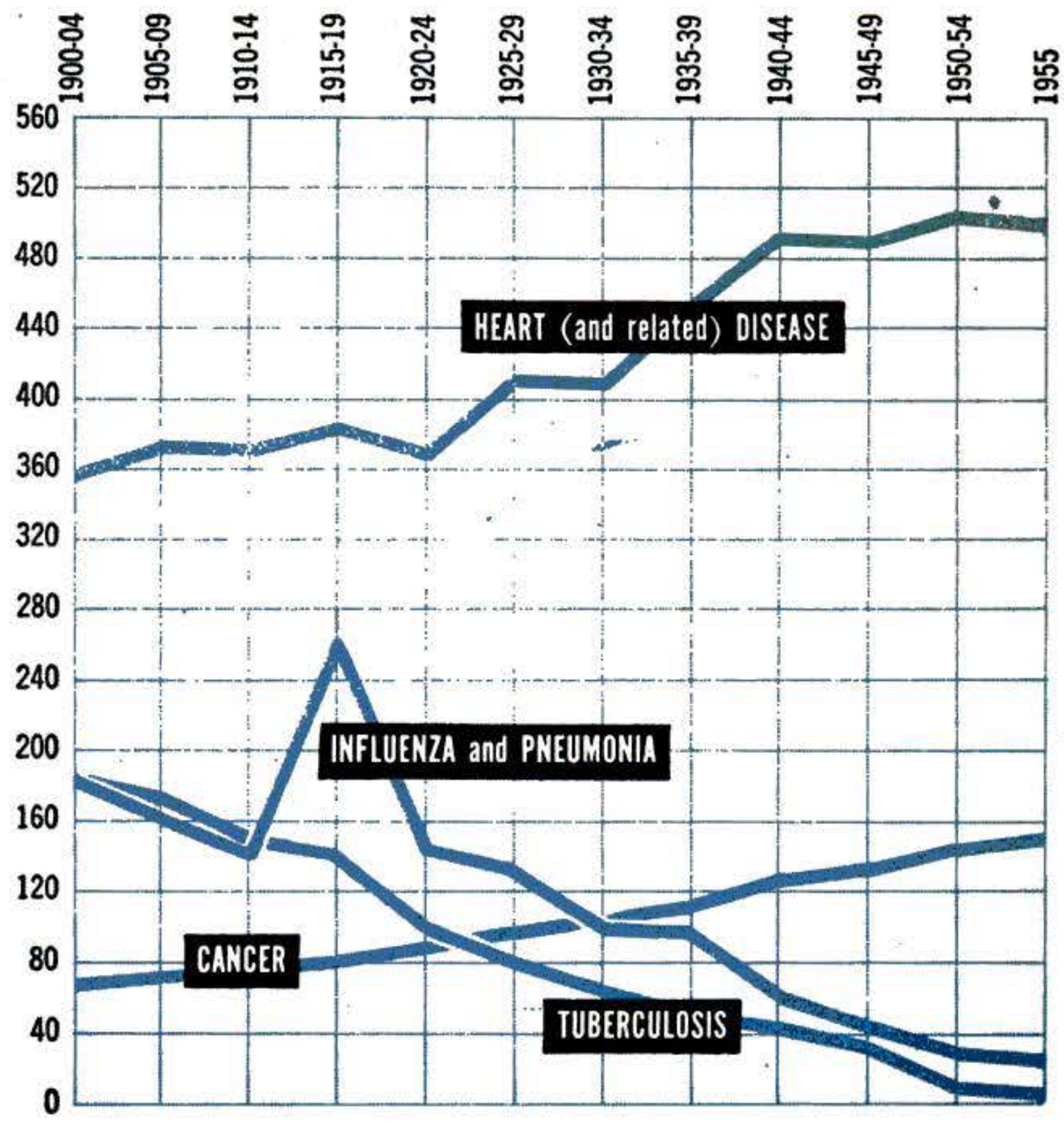
THE average 45-year-old American is about the luckiest man alive—just because he *is* alive.

Even luckier, the odds run three to one in favor of his living for at least another 20 years. And when he does die, it's almost sure to be from something different from what got his grandfather.

None of this may seem like anything to cheer about, especially if you're 45 or over; according to our standards you're just in the prime of life at that age. But historically it's remarkable. For even 100 years ago, the chances of a newborn baby attaining the age of 45 were slim indeed. The average life span in mid-nineteenth century America was only 40 years.

More remarkable: Since this country was founded, U.S. life expectancy has almost exactly doubled—the average baby born in the U.S. today can expect to live for 70 years (as against 35.5 years in 1776), at last fulfilling the biblical promise, "The days of our years are threescore years and ten" (Psalms 90:10).

By far the greatest percentage of this life-lengthening process has taken place within the last couple of decades (even at the turn of the century the average life span was less than 50 years). It comes as the result of man's conquest over scores of age-old pestilences, turning topsy-turvy the patterns of death that guided his destinies from his origin a million years ago until the past few years.



MEDICAL VICTORY over infectious diseases, which kill young, has increased your chance of living long enough to die of cancer or heart disease, as graph of death rates per 100,000 people shows.

Men still die. They always will. But today, by and large, how and when they die are both far different than they were

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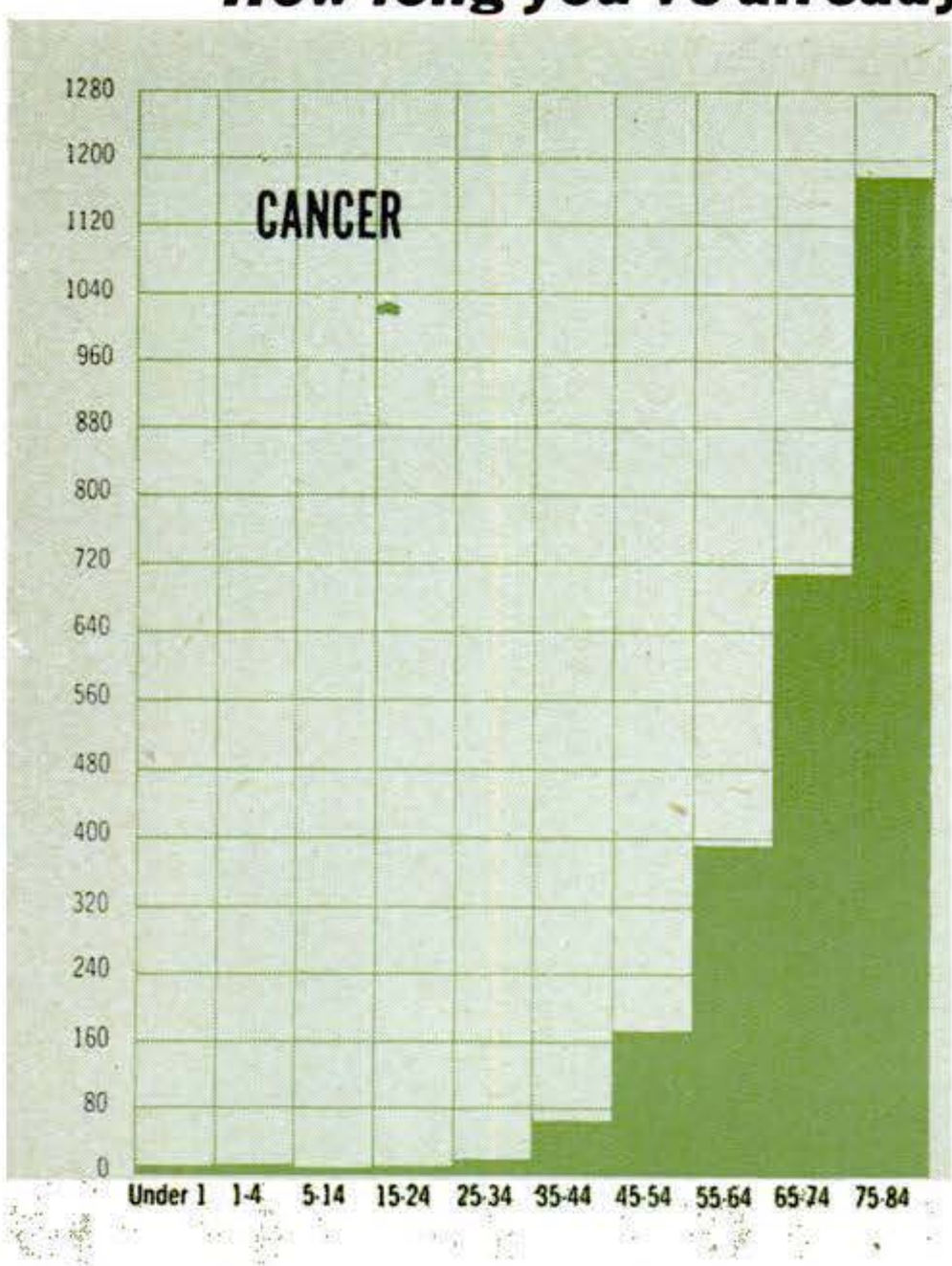
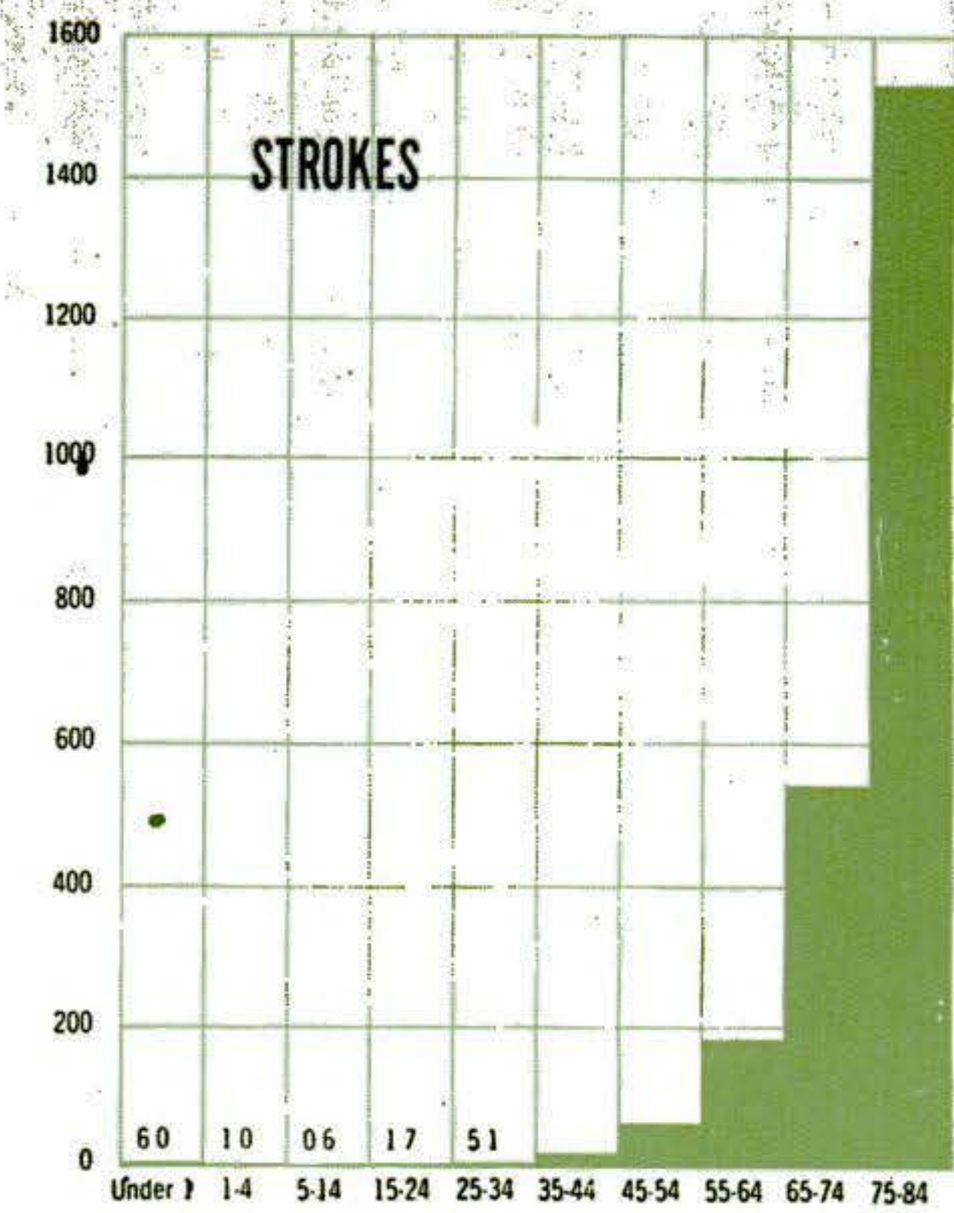
How long you've already lived is one clue to what you might die





THERE'S A PATTERN to the age distribution of fatal diseases. The risk is low during early years, then sweeps up as you grow older, with cancer starting to increase before the diseases of circulation. Accidents are different. They are a greater hazard to the very young and the very old. The charts indicate the number of deaths from each cause per 100,000 people in that age

only an amazingly few short years ago.

The "how" is frightening on an emotional basis, as is any thought of death. But in a practical sense it's encouraging: The three biggest killers today are primarily the major degenerative diseases—heart (38 percent of all deaths), cancer (16 percent), and cerebral hemorrhage (11.5 percent).

NONE of these deaths is pleasant to contemplate. But more than anything else, they underline a completely new pattern in the history of mankind—and new problems as well. For all three are primarily diseases of old age; they are man's biggest threat only because he now lives long enough to fall victim to them. In ages not so far past, the great plagues and epidemics, against whose terrifying onslaughts the best known medical skills stood helpless, would most likely have got him first.

Today none of them, whether caused by bacteria or by the still largely untamed viruses, has any appreciable effect on the broad picture of the nation's mortality tables.

Thus, while less than 60 percent of the babies born in 1900, for example, would live to the age of 50, 90 percent of today's babies will reach that age. This bright outlook comes from the virtual elimination of death from: 1) infectious childhood diseases (measles, scarlet fever, whooping cough, diphtheria); 2) scourges like tuberculosis; and 3) infant diseases such as diarrhea and enteritis.

The Metropolitan Life Insurance Co. figures that diarrhea and enteritis killed far more babies in 1900 than all causes combined do now. Likewise, diphtheria then killed 271 children out of every 100,000—more than 100 times the present rate.

And just 10 years ago, tuberculosis was a leading cause of death among children. Since then, newly developed drug therapy has knocked it down a

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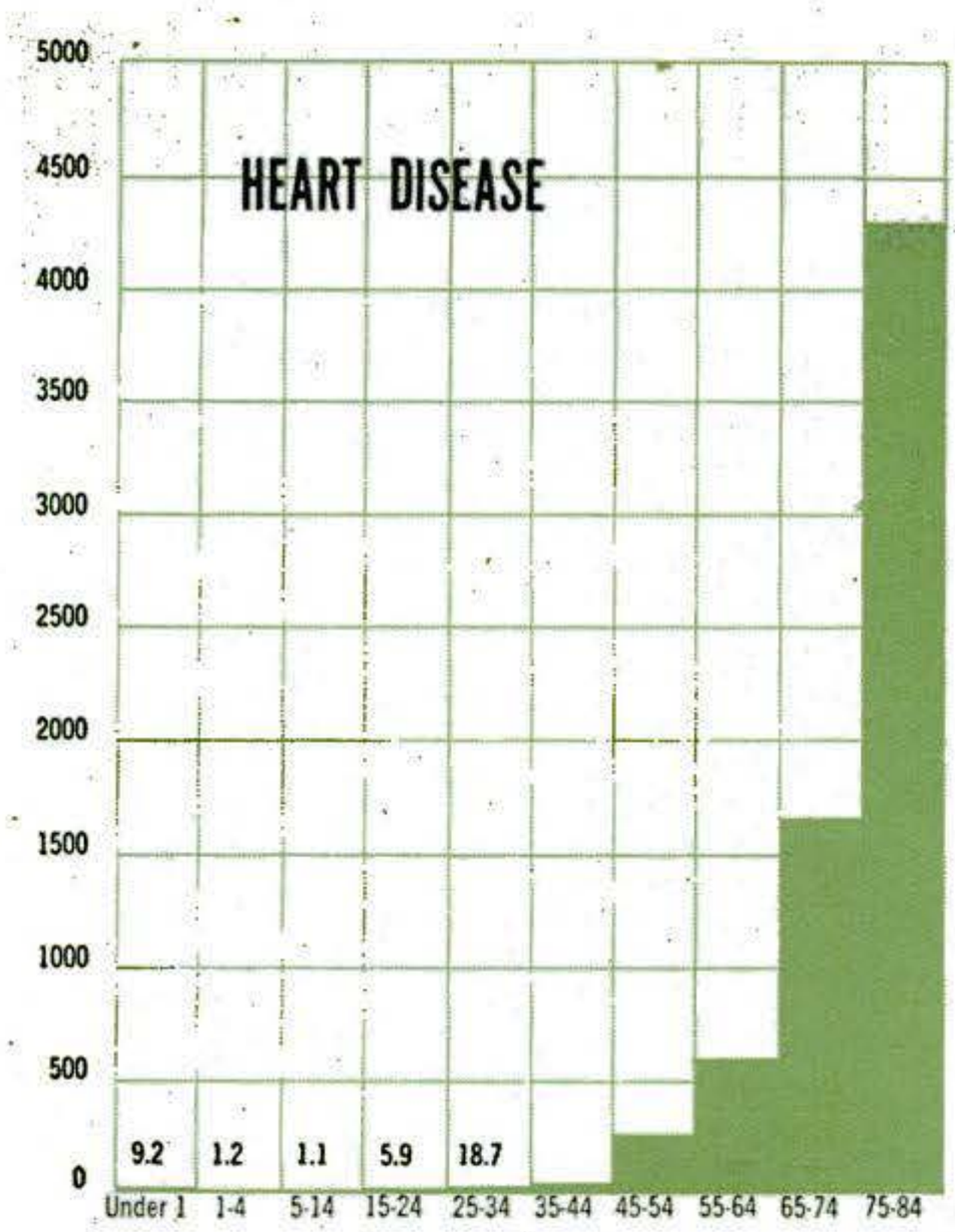
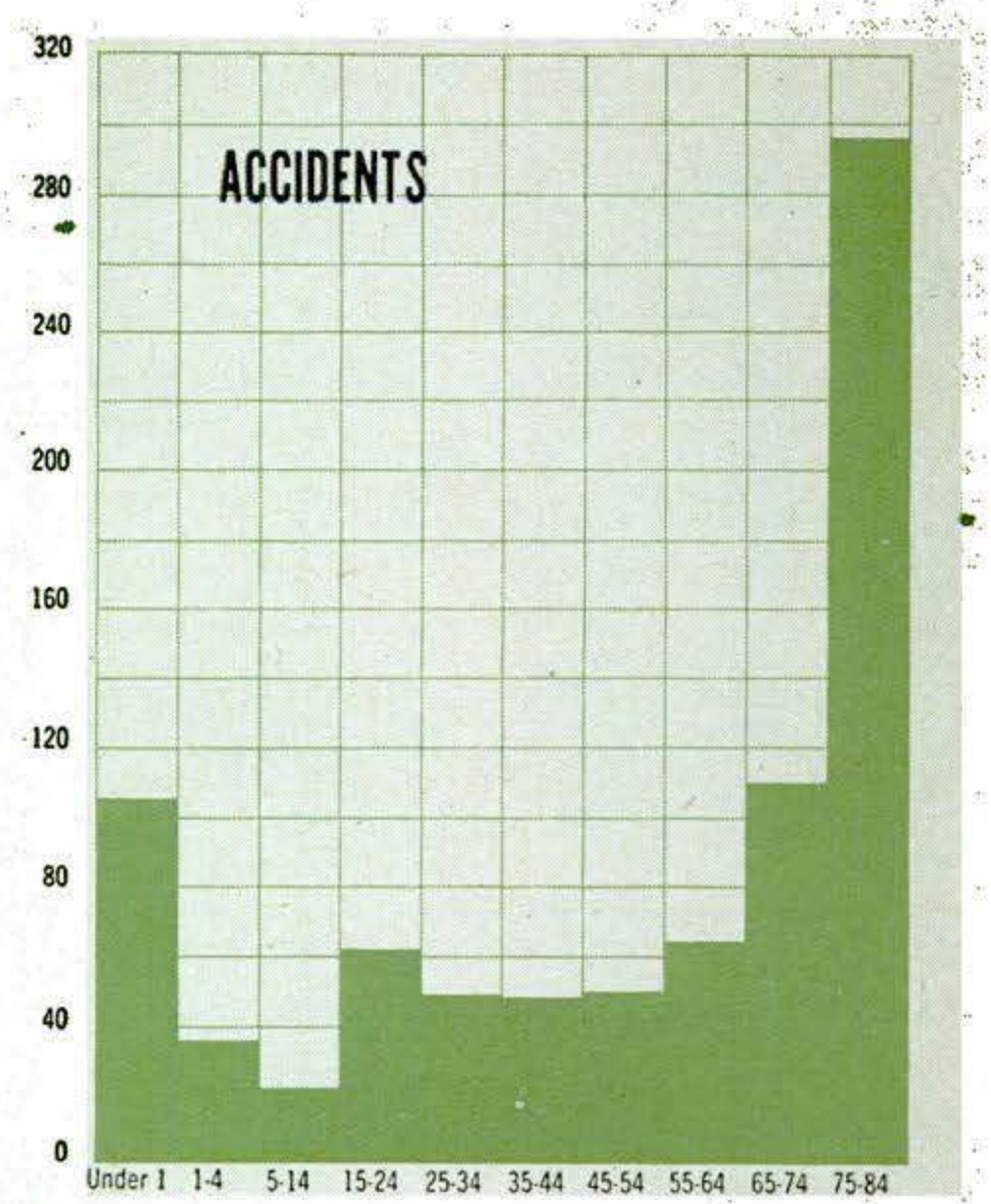
of; the risk from the leading killers depends greatly on your age





group. Figures are for 1953—latest available. The vertical scales are different for each chart (to make them easy to see), so check the numbers on the sides when making comparisons. For the 55-to-64-year-old group, for example, the chart bars look similar, but the death rates vary from about 65 per 100,000 for accidents to about 600 per 100,000 for heart disease.

spectacular 90 percent, making it an insignificant factor in the overall mortality picture, though still a serious disease.

(A noteworthy sidelight: Today's mothers fare better, too. In a single decade, from 1940 to 1950, the maternal death rate dropped by three-fourths—from 34 per 10,000 live births to eight. It's now down to about six. Result: Maternity is generally safer now for women in their late thirties than it was for women in their early twenties—the most favorable age for childbearing—about 10 years ago.)

Because of such improvements, cancer has now taken the lead among diseases that kill children. Yet the figure is still relatively low—about 7.5 percent. The reason is twofold: the dramatic drop in deaths from infectious diseases and the increase in recorded cancer deaths.

THUS cancer has become a far more serious threat to children than the dreaded poliomyelitis. Even in 1950, long before the Salk vaccine with its great promise, fatal polio was a rare disease and accounted for the deaths of only 2.9 out of every 100,000 children, according to figures released by the U. S. Government.

In the broad sense, then, disease has become a relatively insignificant threat to the lives of U.S. children. But children still die—and what kills most of them is accidents. Currently, accidents account for 50 percent of deaths among boys, 25 percent of deaths among girls. And they continue to be the major cause of death until the age of 35. In fact, even though the accident rate has been steadily falling over the years, accidents now stand in fourth place as a cause of death at all ages. Ominous as this sounds, it further spotlights the progress that has been made against other causes of death.

At 35, the degenerative diseases take over the lead from accidents. Among the Metropolitan's insured men, mortality

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from heart disease increases five-fold between the ages of 25 and 44, and more than doubles again during each of the next two age periods.

Then, at age 65, mortality from accidents starts to run at its highest peak (although still below the death rate for degenerative disease). Accidental death from 65 up runs at three times the rate for the 45-to-64 age bracket, seven times that for ages one to 14. Government statistics show that while people 65 and over comprise only eight percent of the total population, they account for 25 percent of all fatal accidents.

PHYSICAL weakness, poor vision and impaired motor functions cause most accidents among the aged. Bones break easily and knit poorly; burns, cuts and the like heal slowly. Complications such as pneumonia and chronic disease set in easily under these circumstances.

Thus the battles that man has won in his struggle for a longer life have benefited the young more than the aged. Between 1900 and 1950, for example, the decrease in the death rate for the under-45 age group amounted to at least 65 percent; but it was only 25 percent for the 65-and-over age group.

This is reflected to some degree in the general but slight lowering of life-insurance rates. They have not dropped in proportion to the increased life span—partly because the biggest strides in longevity have been made among children rather than adults, and adults buy most insurance. (Many other factors, of course, also keep rates up—higher interest and general rising costs have tended to offset mortality gains.)

But maybe by the time the degenerative diseases are ready to catch up with that 1957 baby, they too will have been licked. Signs of this already exist. Strong inroads have been made in both the heart-disease and cancer areas. Neither picture is as bleak as it looks to the layman.

Many people, for example, are dying of heart disease today because of some childhood disease that was not properly treated. Today these factors have been eliminated or cut way down, particularly the effects of syphilis or rheumatic heart. So in 25 or 30 years, these advances in protecting today's babies will show up on the mortality tables—and bring down the deaths from heart disease. Also, surgery and new drugs are already having an effect; they will have more as time goes on.

The same applies to cancer. Already there are thousands of cured cases that stay cured. And by the time today's child reaches 35, there may be as effective a cure for cancer as there is today for pneumonia.

Assuming these two big killers have been tamed by then, what will the 1957 baby die of?

At the moment, it appears that his greatest enemy will still be accidents. Many authorities feel that accidental death will begin to climb again, due to the increased mechanization of our age. Right now 40 percent of all accidental deaths come from automobiles, and there's every indication that this percentage will rise rather than fall.

The very pressures of an increasing population and a growing, developing economy may bring new ills. One example: Air pollution from exhaust gases and industry have an effect on health and life itself.

STILL more important: What is this growth and expansion doing to mental health? There is an increasing awareness of the mental-health problem and its relationship to fatal diseases. Some day mental illnesses may have to be included in health and death statistics—which they aren't now.

What about radiation as a modern problem? The atomic age is still in its infancy and it's too early to tell the extent of the effects of radiation on human life and health. But as nuclear power becomes more widely used—as it will be—it could be a vital factor in the mortality tables for the 1957 baby. Or it could be completely insignificant.

Right now, nobody knows. END

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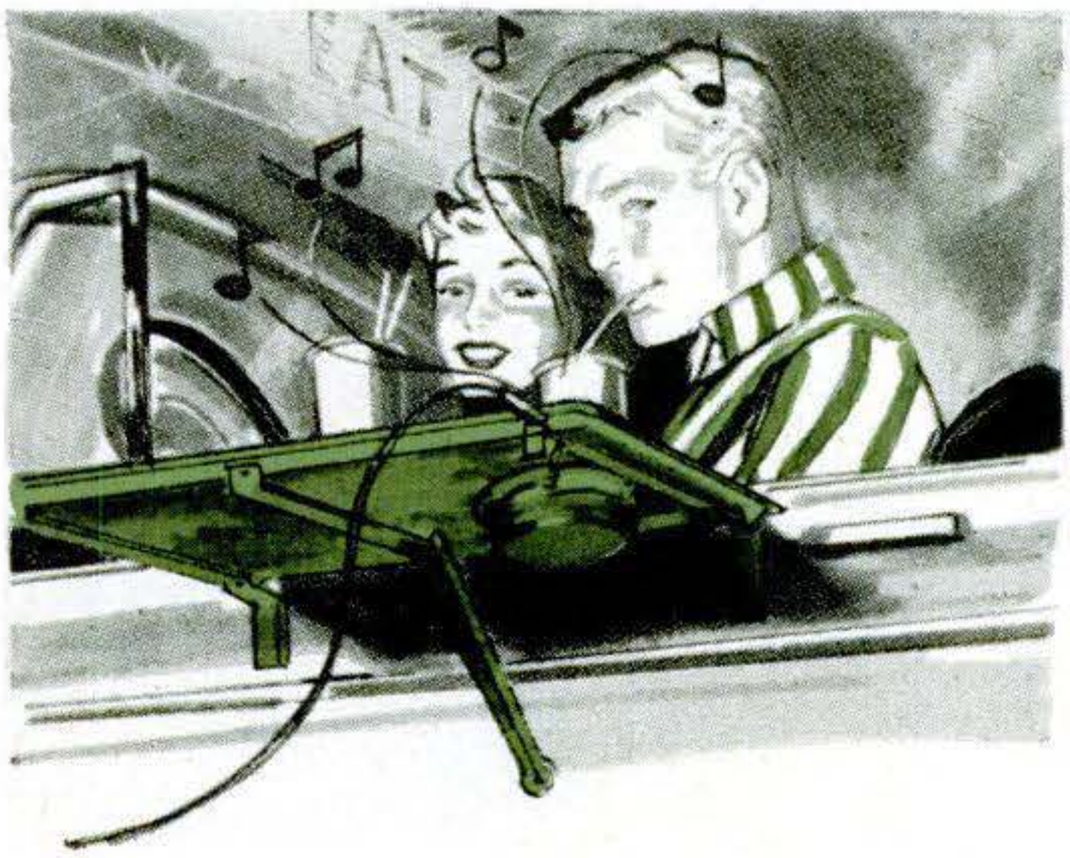
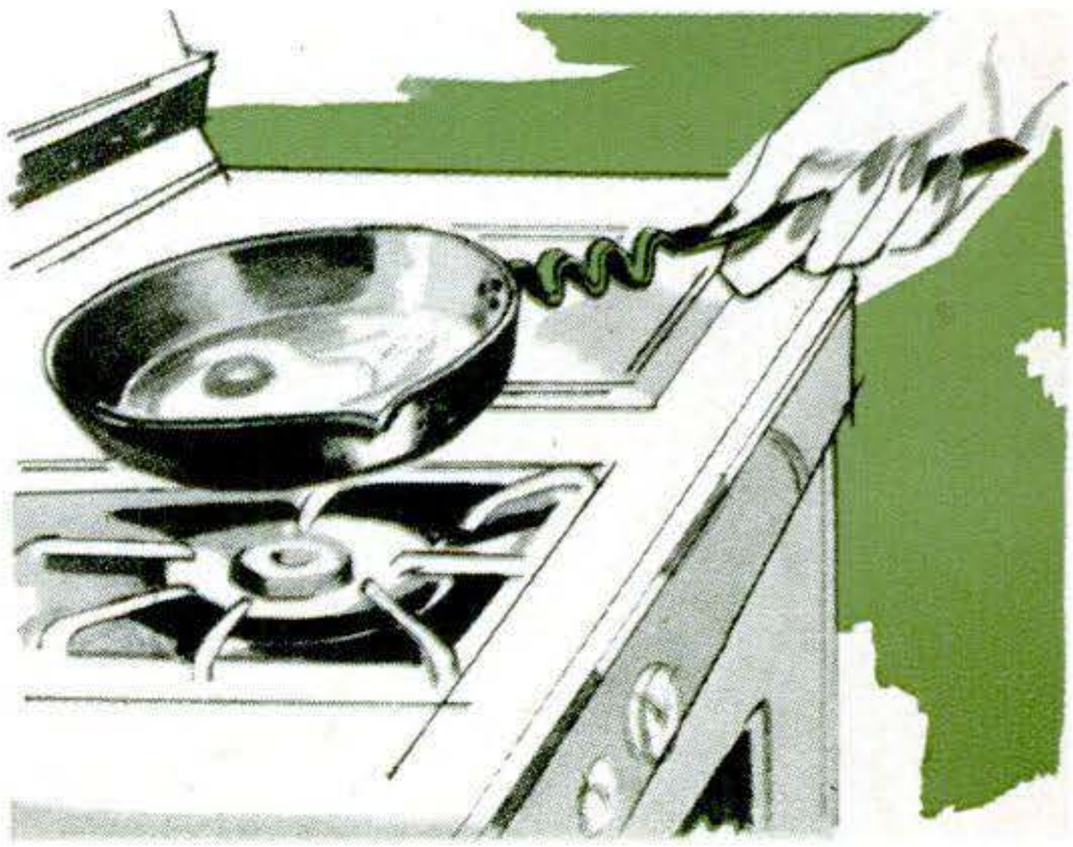
New Ideas from the Inventors

1 Catamaran to Change Decks. Interchangeable deck boards that would be fastened to bolts imbedded in two watertight pontoons would let you adapt this versatile catamaran for outboard-motor, sail or paddle power. In knocked-down form the boat could be compactly stored and easily carried to the water.

2 Car Tray to Serve Music. You wouldn't have to run your car radio—and run down your battery—to enjoy dinner music at this drive-in eatery. A loudspeaker (and individual volume control) mounted in each tray would plug into a central sound system.

3 Pan Handle to Cool Itself. You'd have less need for pot holders if uninsulated metal handles of cooking utensils were formed with corrugated or zigzag sections. By dissipating heat, a bent-metal portion would make the handgrip more comfortable to the touch.





Please turn the page for more new ideas

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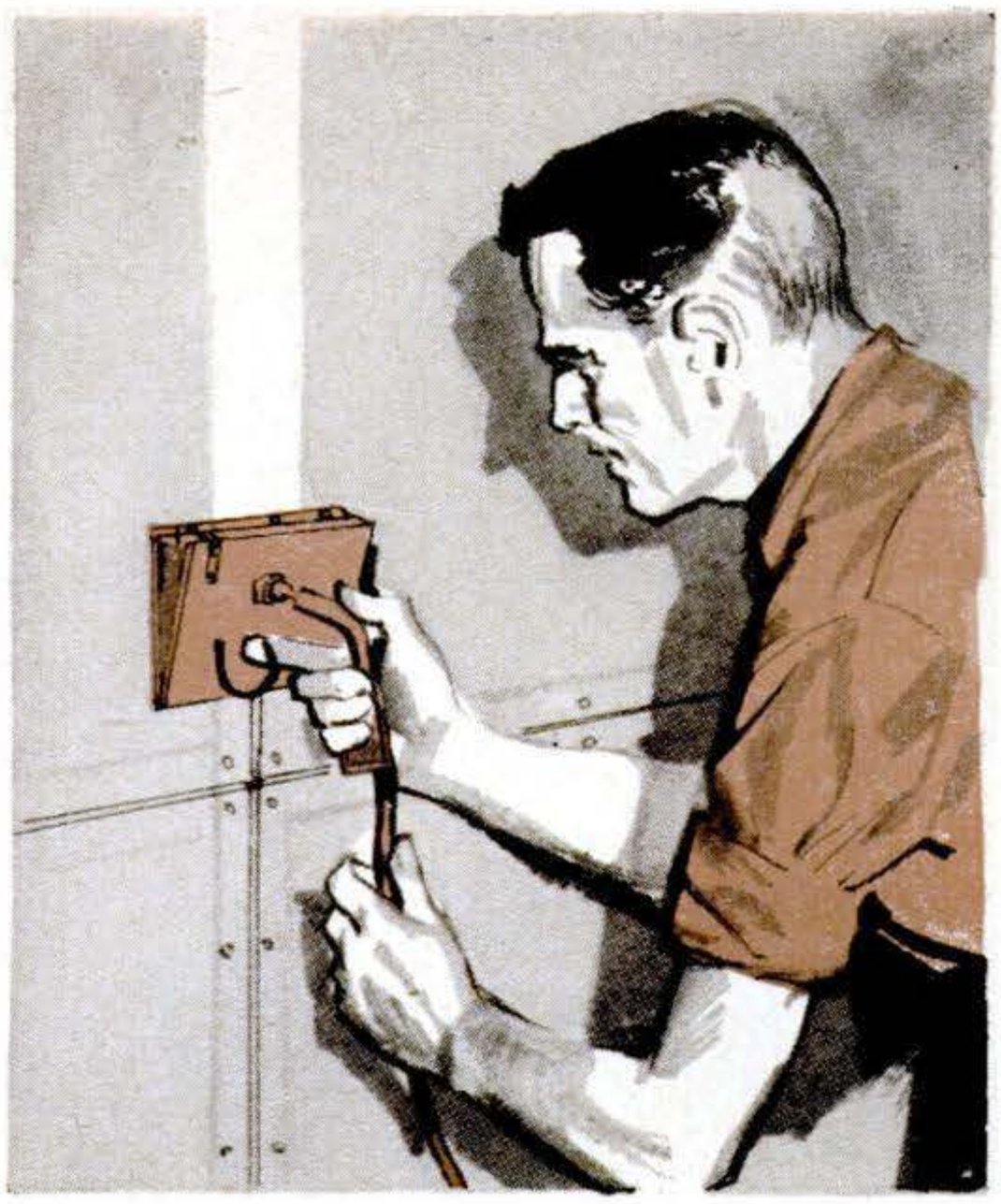
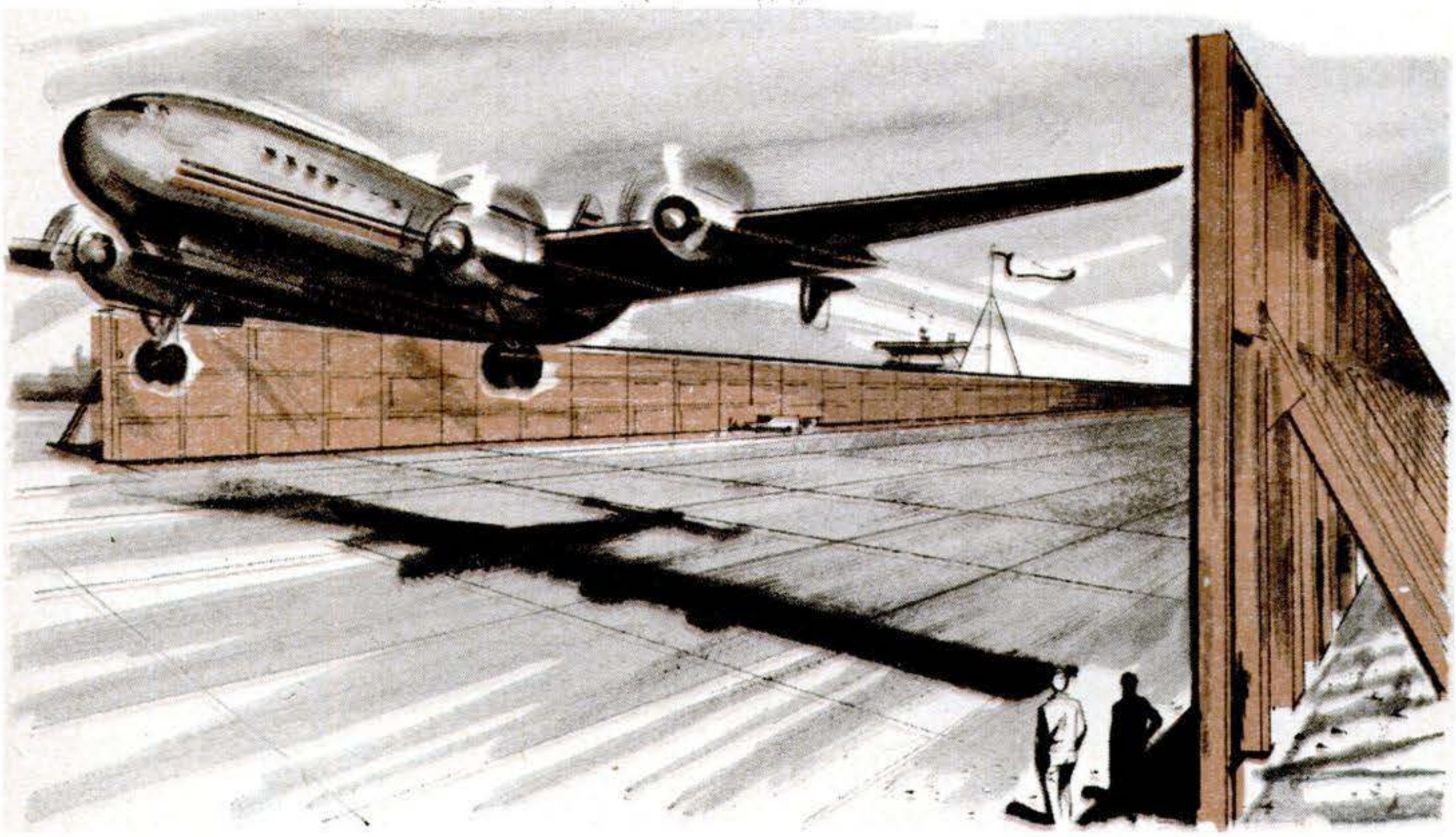


4 Canopy to Cover Carriage. Slipped onto the pivot bolts of a regular baby-carriage canopy, this fold-up umbrella would shield blankets as well as baby from sudden rains. It would also afford more sun protection than the usual canopy while allowing freer air circulation.

5 Gun to Apply and Shape Filler. A pump and reservoir in this self-feeding trowel would let you apply mastic directly to a plasterboard or other surface. By manipulating the tool, you could fill gaps and nail holes and smooth the filler surface in a single operation.

7 Runway Fences to Block Winds. With fences to disperse crosswinds, says the inventor, planes could land or take off regardless of wind force or direction. Airports could be built with several parallel runways instead of space-wasting crisscross ones, speeding traffic while cutting construction costs.



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6 Ax to Sheathe Knife. This knife and ax combination could lighten your camping kit while allowing you to keep both implements handy. The knife could be used separately, or (with its blade locked into the ax-shaft socket) would become part of the ax handle.

8 Reserve to Signal Gas Shortage. Installed between fuel pump and carburetor, a self-filling tank would relay a normal flow from the gas line until the main supply failed. It would then dole out its reserve at a rate allowing only low speed, warning you to refill as your car limped on to a gas station.

9 Clock to Tune In TV. You'd only have to check your program listings once a day if you had this clock-operated channel selector wired into your receiver. You would preset the device for the channels and hours you wanted. It would then change stations and turn the television on or off, according to schedule.

The following patents *have been issued on these inventions: 1. Patent No. 2,748,740 to Manuel P. Villar, Coral Gables, Fla.; 2. No. 2,746,559 to Ivan W. Mastin, Bellingham, Wash.; 3. No. 2,693,295 to Fred A. Fasano, Richmond Hill, N. Y.; 4. No. 2,706,993 to Sylvia Forrest, Lynbrook, N. Y.; 5. No. 2,711,098 to Robert G. Ames, Burlingame, Calif.; 6. No. 2,717,442 to Larry Smith, Castro Valley, Calif.; 7. No. 2,765,994 to Assen Jordanoff, Great Neck, N. Y.; 8. No. 2,734,561 to Hayes W. Funkhouser, Pipersville, Pa.; 9. No. 2,755,424 to Gene Papitto, Chicago Heights, Ill.*

Copies of patents may be ordered, by number, from the Commissioner of Patents, Washington 25, D. C., at 25 cents each. To write to an inventor, if the address given above is insufficient, you may address him (by name and patent number) in care of the Commissioner of Patents.

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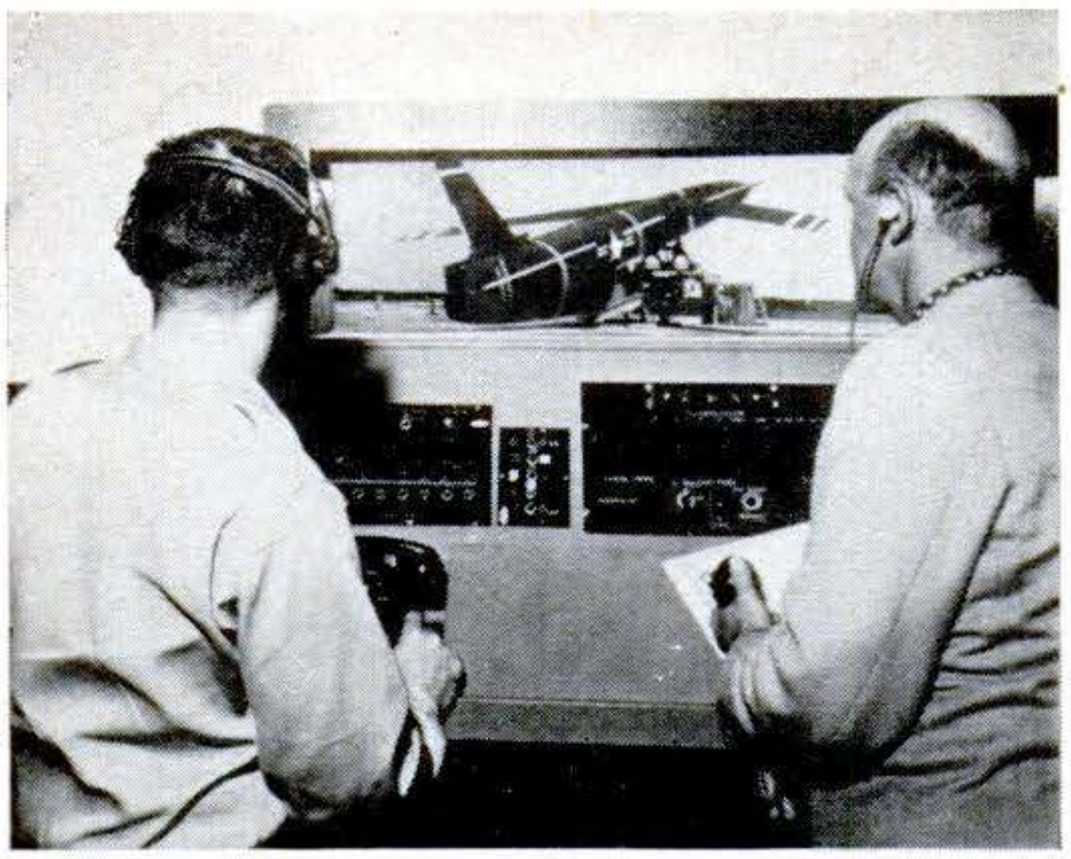


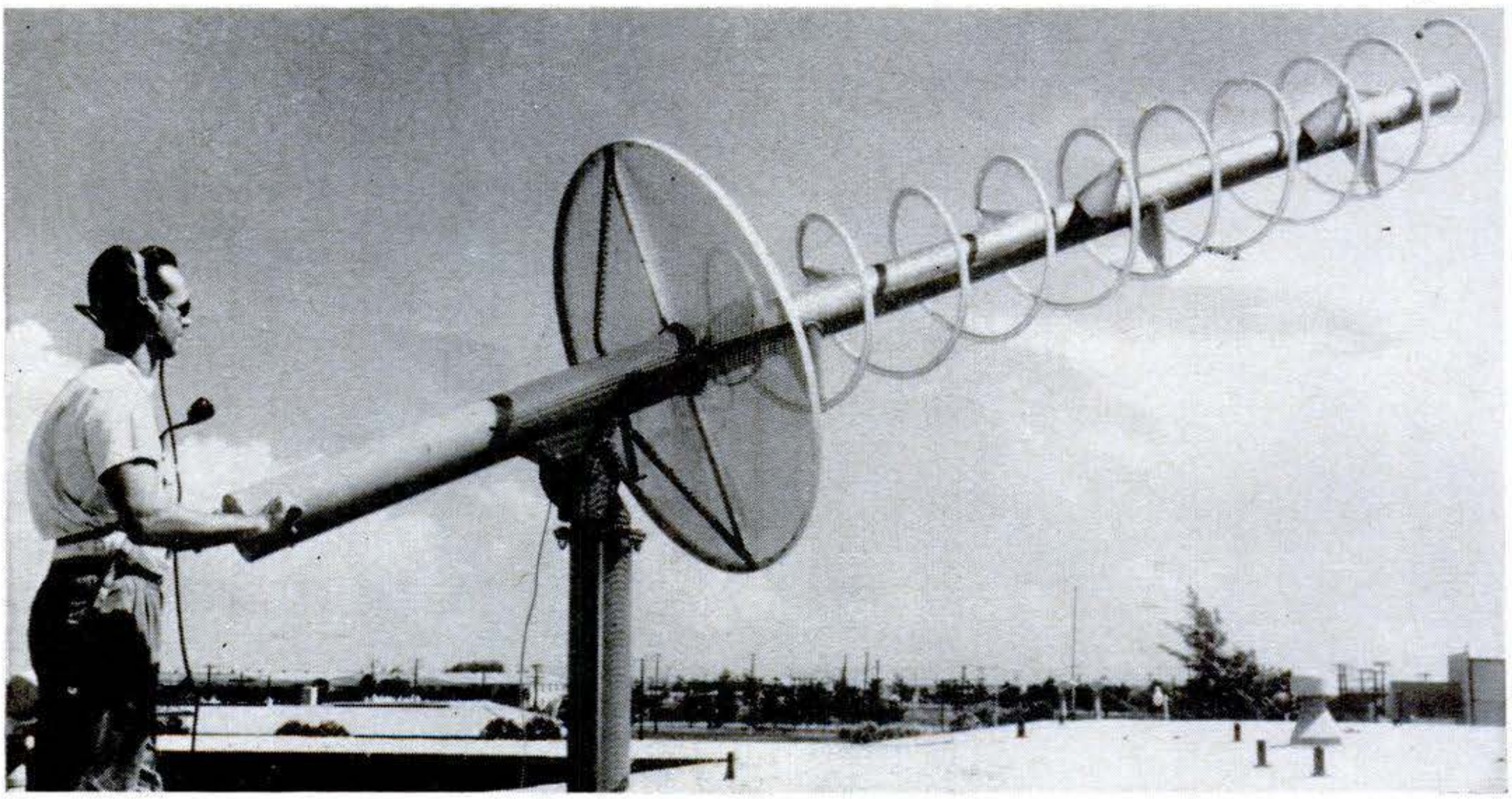
LAUNCHING-SITE TECHNICIANS give equipment a last-minute check as missile, seen through observation window, is made ready for firing.

AT TAKEOFF, missile draws lenswork like a celebrity facing the press. Up to 75 cameras film it, including this one with binocular sights.

Island Outposts Track Ocean-Hopping Missiles

OBSERVERS catch test data on the fly as long-range missiles, launched from Florida, whoosh over their stations —a chain of Atlantic outposts, eventually to reach 5,000 miles to Ascension Island. How they do it with electronic and optical tracking devices, installed and operated by the Radio Corporation of America, is shown in accompanying U.S. Air Force photos. A single missile flight may result in 50,000 feet of camera film, 100,000 feet of magnetic and punched tape, and finally a 50-to-100-page Flight Test Report telling every detail of a missile's performance, such as speed, altitude, rate of climb, and fuel consumption.

TELEMETRY ANTENNA, resembling big corkscrew, receives data by radio from instruments and transmitter aboard missile itself as it speeds past. Downrange observing stations on eight Atlantic islands along present test course are manned by an average of 80 technicians apiece.



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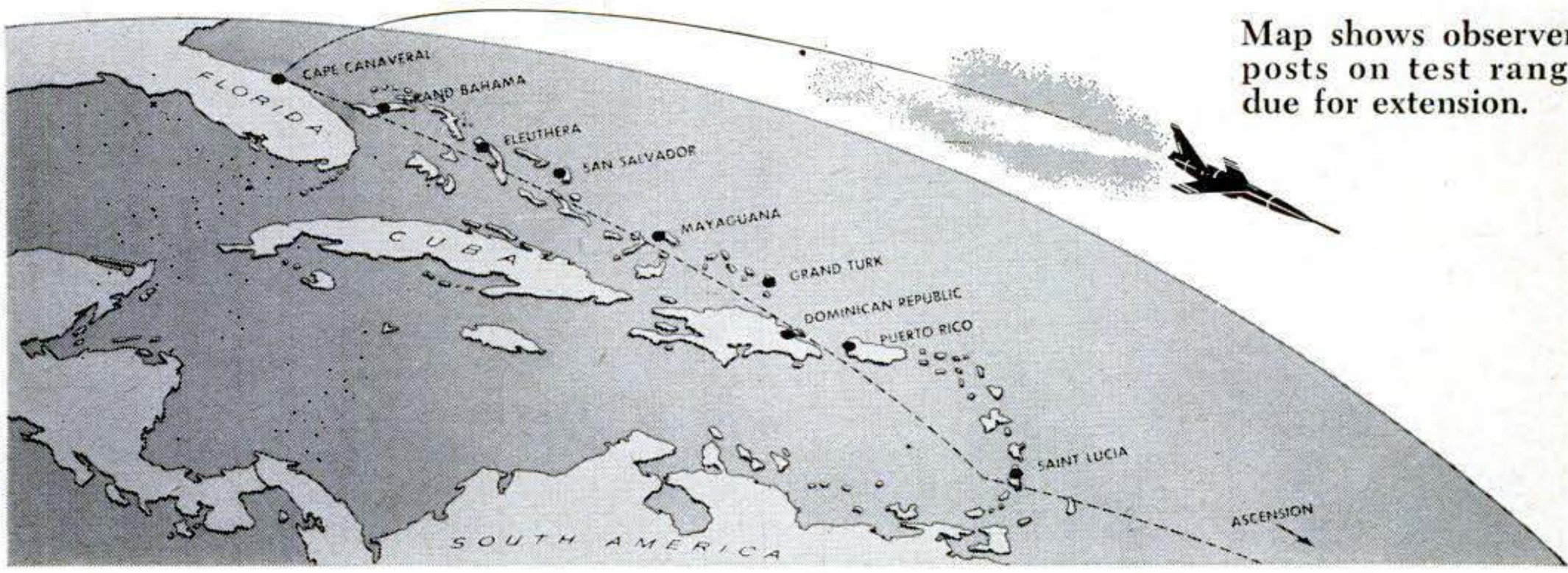
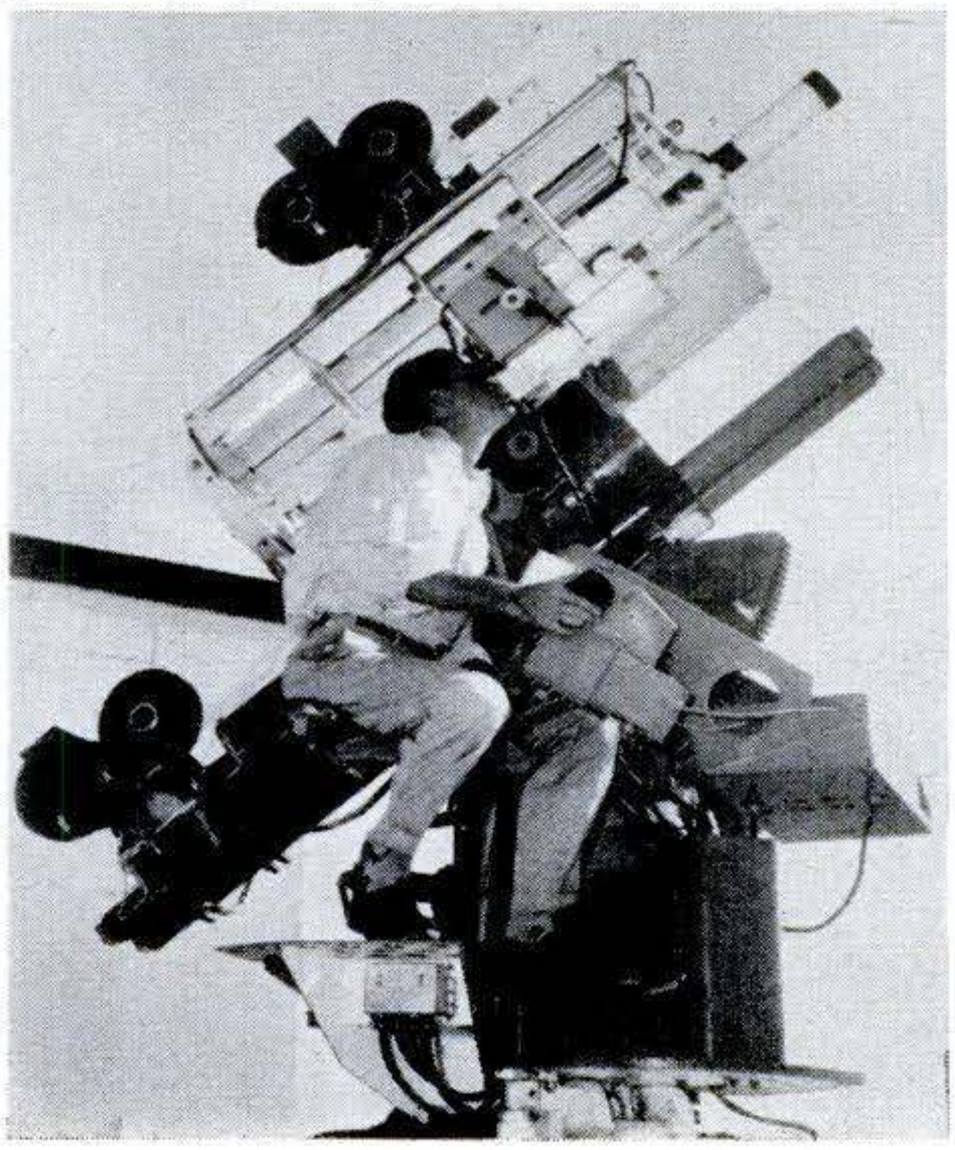
GETTING UNDER WAY with aid of rocket booster is first intercontinental missile in U.S. arsenal —the Air Force's 69-foot subsonic, jet-propelled Snark. Downrange, observers at a chain of stations stand ready to gather performance data by radio, photography and radar.



Map shows observers' posts on test range, due for extension.

LONG-RANGE CAMERA on tracking telescope, aimed by observer at sighting tube, gets high-speed photos of missile in flight.



RADAR SYSTEM, with bowl-shaped antennas like these at all posts, charts exact course of missile. In turn, each island's installation comes into play.

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Gus tackles

When Gus attempted some roadside repairs on a 33-year-old

By Martin Bunn

BILLY Knowles was 11 years old, tanned brown as a hazel nut, with wide, blue eyes and an expression of extreme innocence. He came into the Model Garage, knelt on the cement floor to peer beneath a car at Gus Wilson.

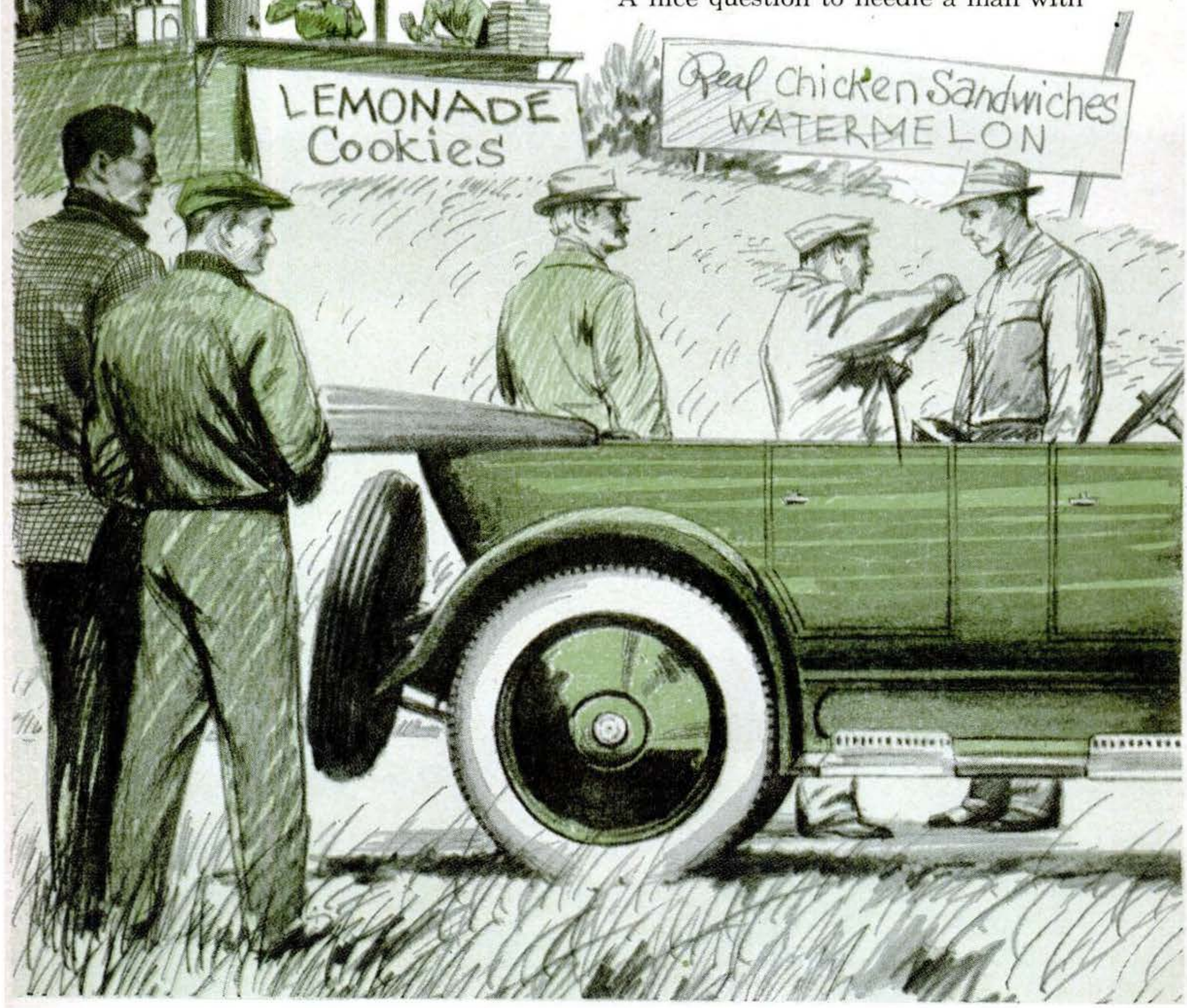
"Hello, Mr. Wilson," he called. "What are you doing?"

"Bearing job, Billy," Gus told him.

"Work like that must make a person awfully hungry," Billy said. "Aren't you hungry, Mr. Wilson?"

Gus pondered a moment. Then he shot out from beneath the car, grasped Billy and rumpled his carroty hair.

"A nice question to needle a man with



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an antique

car, he drew a crowd of hecklers—just what he had in mind.

just before lunch," he roared in mock anger. "What are you trying to sell this time?"

"I'm not selling anything," the kid giggled, squirming mightily.

"Oh, no!" Gus declared. "Come clean now. What's this all about?"

Billy drew in his breath, as if he were getting ready to take a deep dive.

"Well," he explained, "Mr. Perkins said that you could eat more than anybody in town. So we thought that you might be extra hungry today and we wouldn't go busted and all."

"Busted and all!" Gus exclaimed. "What kind of language is that? And what's my appetite got to do with this?"

"Us fellows are raising money for our baseball team," Billy said. "You know, Mr. Wilson—the Blue Eagles. We've got a lunch stand out in front of our place on the highway."

"I see," Gus said.

"Our folks will only let us run the stand over this weekend," Billy went on. "We've got to sell enough in these two days to buy our gloves and balls and such. Then we'll have to close up. We haven't sold anything, so far, and our ice is melting, and all."

"And," Gus said, "you expect me to come out there with my ferocious appetite

"She misses," Gus announced. "Warm, isn't it? Man, what I'd give for a nice, cool drink!"

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and eat up the whole works, is that it?"

"Stay with him, Billy," Gus's helper, Stan Hicks, called from the bench. "A gallon of lemonade and a dozen pies are just a starter for Gus."

Gus shot an outraged look at Stan. "Hah," he snorted. "Al Perkins and his jokes. Maybe I will drop out to your stand for lunch, after all, Billy."

At 10 minutes before noon, Gus called Al Perkins.

"Al," Gus said over the phone, "we're still pretty well snowed under, but if you'll run that car that misses over here at noon, I'll try to take care of it on my lunch hour."

Al Perkins, who ran a restaurant down the street, was a nut on old cars. He owned several, one of which was giving him trouble. He arrived at the Model Garage at noon, driving a 1924 Flint touring car. A rakish vehicle, it was as sleek as the day it came from the factory: gleaming paint, fawn-leather upholstery, huge polished headlights.

"Whew!" Stan Hicks exclaimed admiringly. "That thing is enough to stop traffic anywhere."

"Isn't it, though!" Gus said thoughtfully as he slid beneath the wheel. "Let's give this thing a road test, Al."

The Flint, manufactured in the mid-twenties, was a sweet-running job in its day. It didn't run sweetly now. It leaped forward in a series of missing gallops.

"Should be easy to find the trouble," Gus commented.

"Easy!" Perkins protested. "I've had one mechanic after another work on it. They went over it with fine-tooth combs."

"You don't tell me!" Gus said, as he continued to drive haltingly down the highway. "In that case I guess I've a tough nut to crack here, haven't I?"

HE PULLED off the highway a mile out, near a tree in front of the Knowles' farm. Across the highway a rickety stand announced with crudely lettered signs that here one could purchase "Mom's Home Made Apple Pie," "Real Chicken Sandwiches, Watermelon," "Lemonade, Cookies." Without a glance at the lunch stand, Gus lifted the hood and peered at the motor with a look of complete bafflement.

While he was cleaning and checking the spark plugs a Cadillac sedan slowed, swerved to the highway shoulder and halted. Four men hastily descended and approached the gleaming Flint.

"An old one!" one man said admiringly.

"She misses," Gus told him, as he slipped a thickness gauge between the electrodes of a plug. "Twenty-five thousandths' gap is about right, don't you think?"

"Thirty," the man said positively.

"You don't say!" Gus replied, giving him a long-handled Flint crank. "Turn her over for me, will you, mister, while I check the compression."

While the Cadillac driver was enthusiastically cranking the old motor, two more motorists pulled up to inspect the Flint. And as Gus checked the wiring and connections, timing and ignition points, several more cars stopped when their drivers and passengers spotted the old automobile. Gus straightened from beneath the hood with a friendly smile for all.

"She misses," he announced. "Warm, isn't it? Man, what I'd give for a nice, cool drink!"

"Those kids over there," the man with the crank said, "are selling lemonade."

"By golly, so they are!" Gus exclaimed. He strode toward the lunch stand, calling, "Let's wet our whistles, Perkins."

The Flint's owner followed. So did the onlookers. When Billy Knowles saw them crowding up, his blue eyes held a look of astonishment. It altered to a sly grin when Gus winked at him.

"Lemonade, sonny," Gus said enthusiastically. "And how about a piece of pie and one of those chicken sandwiches."

SUDDENLY, the Blue Eagle baseball team found themselves dipping lemonade, cutting pie, serving sandwiches and watermelon to a gathering engaged in deep mechanical discussion.

"If you ask me," a lean, long-nosed man asserted, "it's a loose connection at the ammeter. Reminds me of my Durant. I was courting Myra Phelps that evening when it began to miss. I crawled under the dash and . . ."

"Ammeter!" Gus exclaimed. "I'll have to check that."

"Could be," another bystander said doubtfully, waving a half-eaten sandwich. "But I'd be more inclined to think it a cracked distributor cap."

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These people Gus thought, were getting him all confused. He wondered what really *was* wrong with the car. Maybe, he figured, it was time to quit fooling around and get on the ball. He couldn't let an antique like this stump him.

Gus went back to the Flint and started the motor, under the interested eyes of a group who gulped lemonade from paper cups, munched sandwiches, and spat watermelon seeds at random. The motor still missed. A quick check, by shorting each plug, proved to Gus that it wasn't missing on any particular cylinder, but on all cylinders, erratically, between periods of regular firing. To Gus this meant an intermittent break in the primary ignition circuit, eliminating the possibility of trouble in the secondary circuit.

Gus found himself stumped by the very care that Perkins had been giving the old car. New wiring, coil, carefully adjusted and cleaned parts—there simply was no place to hunt trouble. Yet there had to be an interrupted flow of primary ignition juice somewhere. Gus's mind went back over the years to when cars like this were coming from the factories.

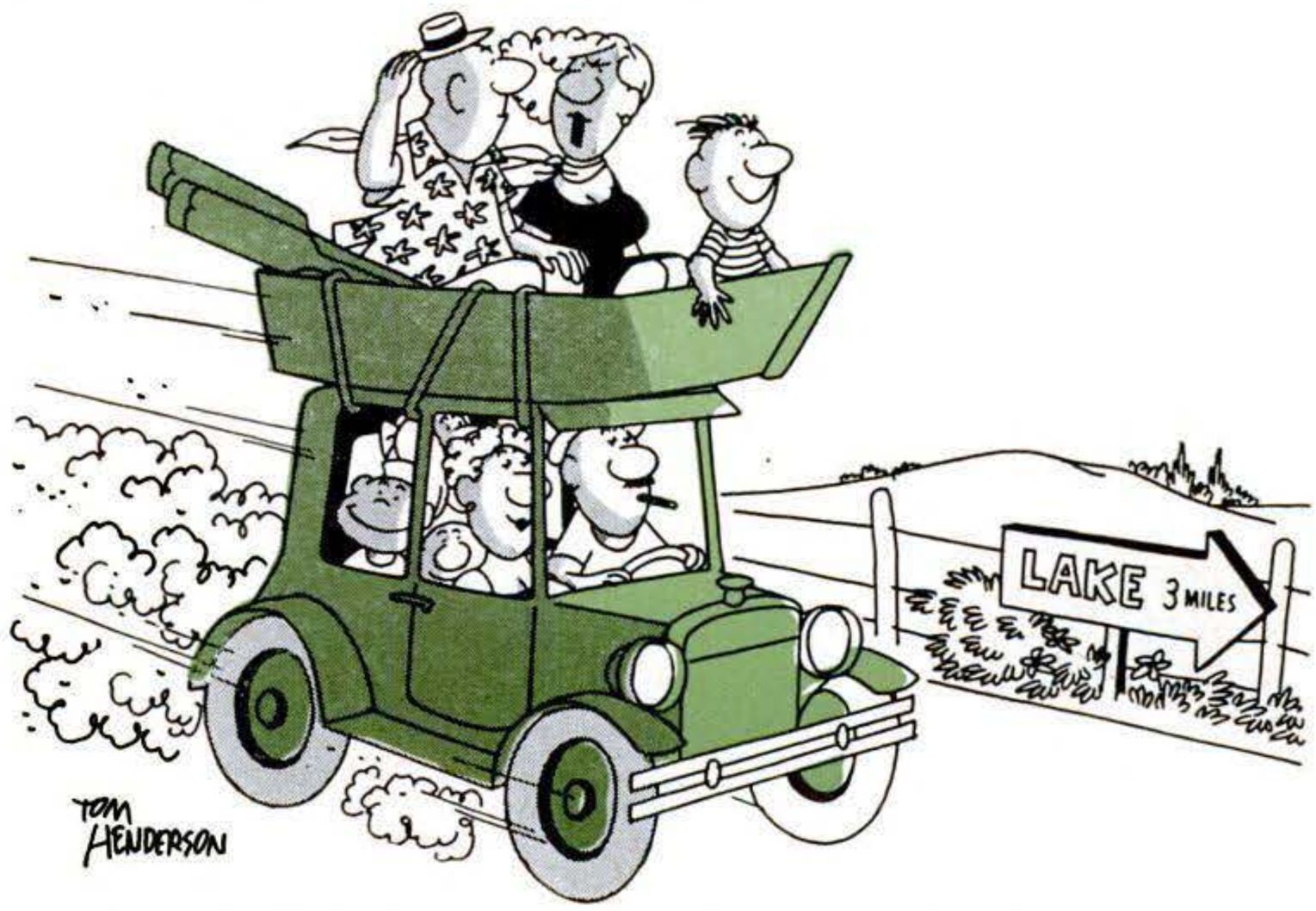
WHAT had been their troubles then? He thought of the low-voltage generators, the poor batteries, the hand cranking and that trick of retarding the spark at the wheel to escape a kick and a broken arm. His mind focused on that manual spark-advance-and-retard system. The Flint had seen many changes since its youth, but was still equipped, Gus noted, with an ignition system featuring a manual spark control through a lever at the distributor, which was attached to the ignition-point breaker plate grounded to the distributor body.

Regardless of new wiring, coil, finely honed and set ignition points, intermittent missing would develop if that movable breaker plate upon which the ignition points were mounted did not have a proper and continuous ground.

Gus was eager now. He started the motor, grasped the spark-control arm where it issued from the distributor, wiggled it back and forth rapidly, then bore down on it to throw it into a bind. Instantly the Flint motor smoothed out, purred like a kitten. The onlookers were quick to catch the change in rhythm.

"Ah!" they breathed in unison.

Gus hooked a weak coil spring from spark-control arm to splash pan below. It would hold the arm in a grounding bind until he could drive back to the Model Garage for a permanent repair. Billy approached to whisper in Gus's ear.



"Don't need our car, eh? Plenty of room in theirs, eh? Well, it's not my *idea of room!"*

"Thanks, Mr. Wilson," he whispered. "We're all sold out. Gee willikins, that Mr. Perkins must have been pulling my leg. He ate three times as much as you."

"This was one of my off days," Gus explained.

Driving back to town, Al Perkins leaned back in the seat and loosened his belt from his rotund stomach. He sighed with content as he listened to the motor purr.

"Sweet job, isn't it?" he said. "They don't make them like this one any more. Gone but not forgotten, eh?"

Gus had to agree with him—gone but not forgotten, at least by those who had known these cars back when they, and the cars, were young. END

NEXT MONTH: Gus rescues a rival.

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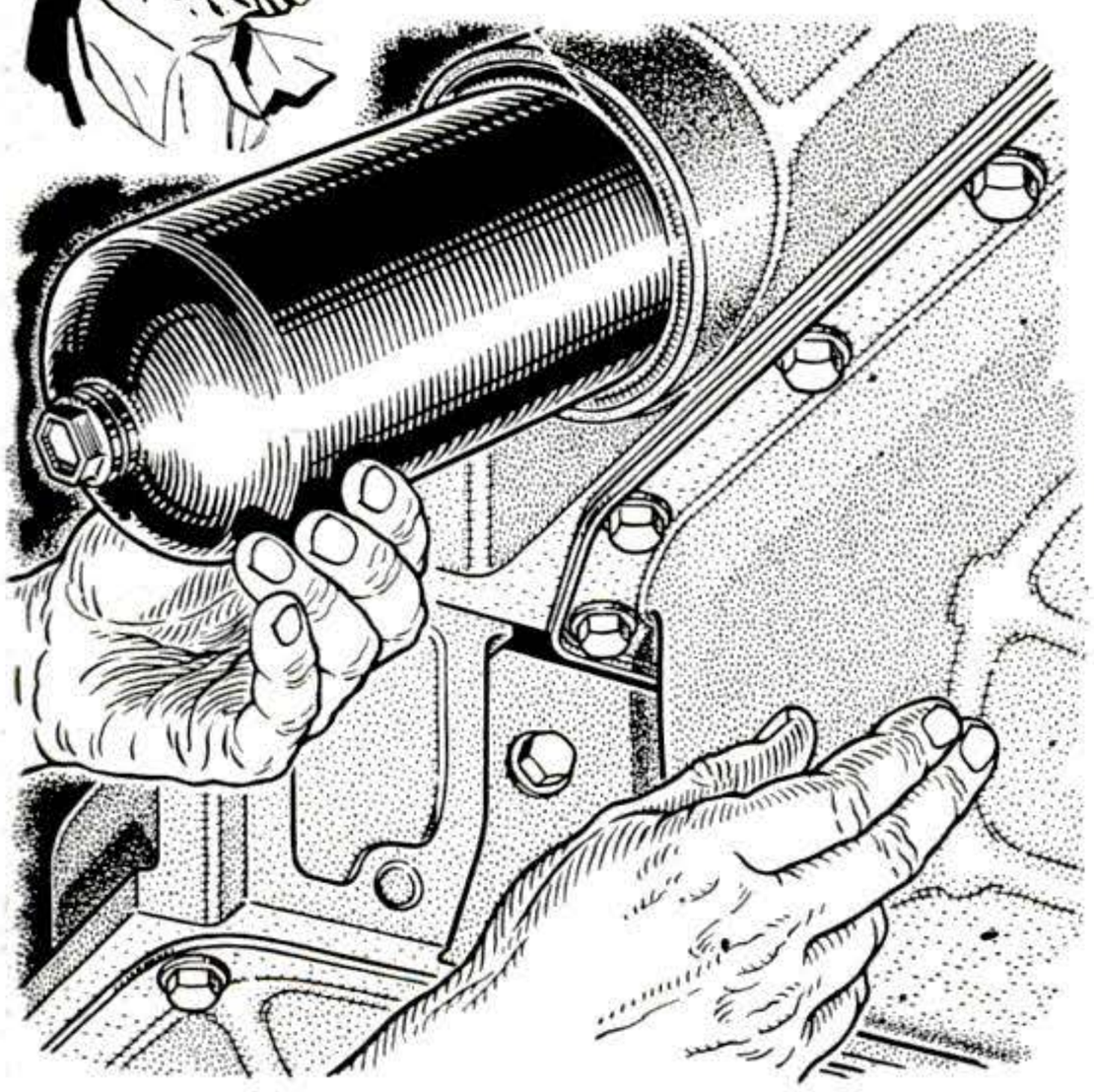
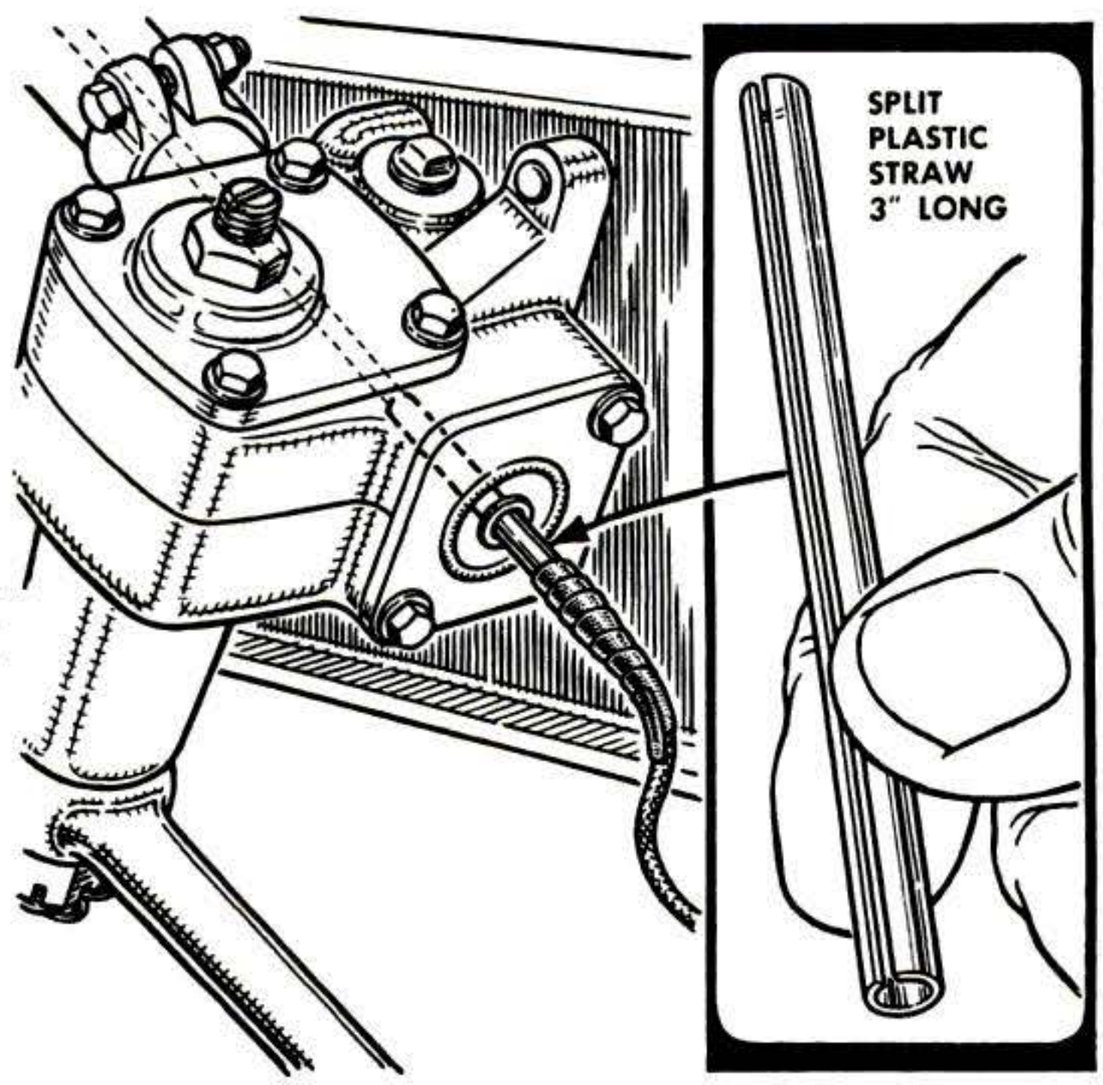
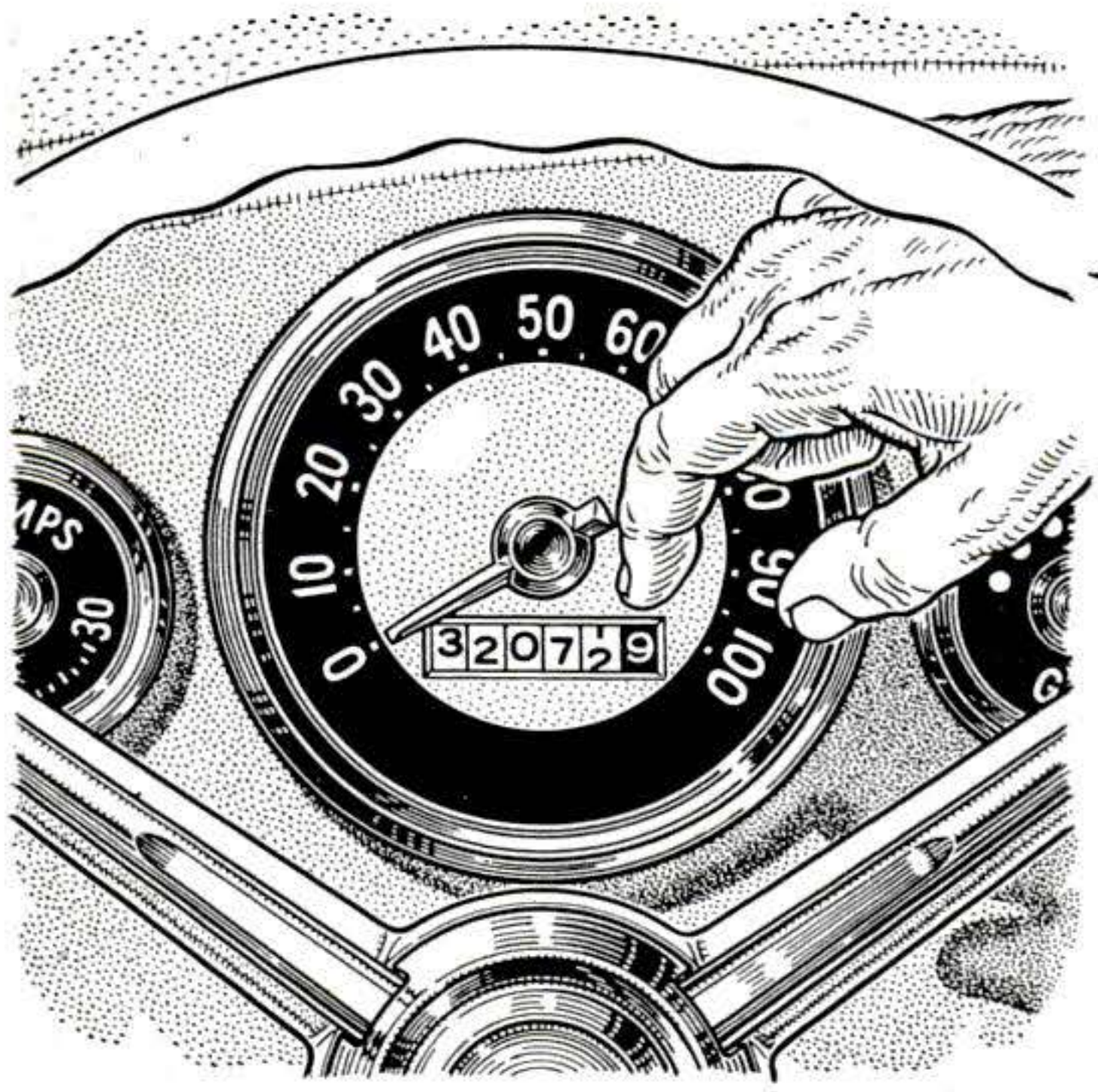
Hints from the Model Garage



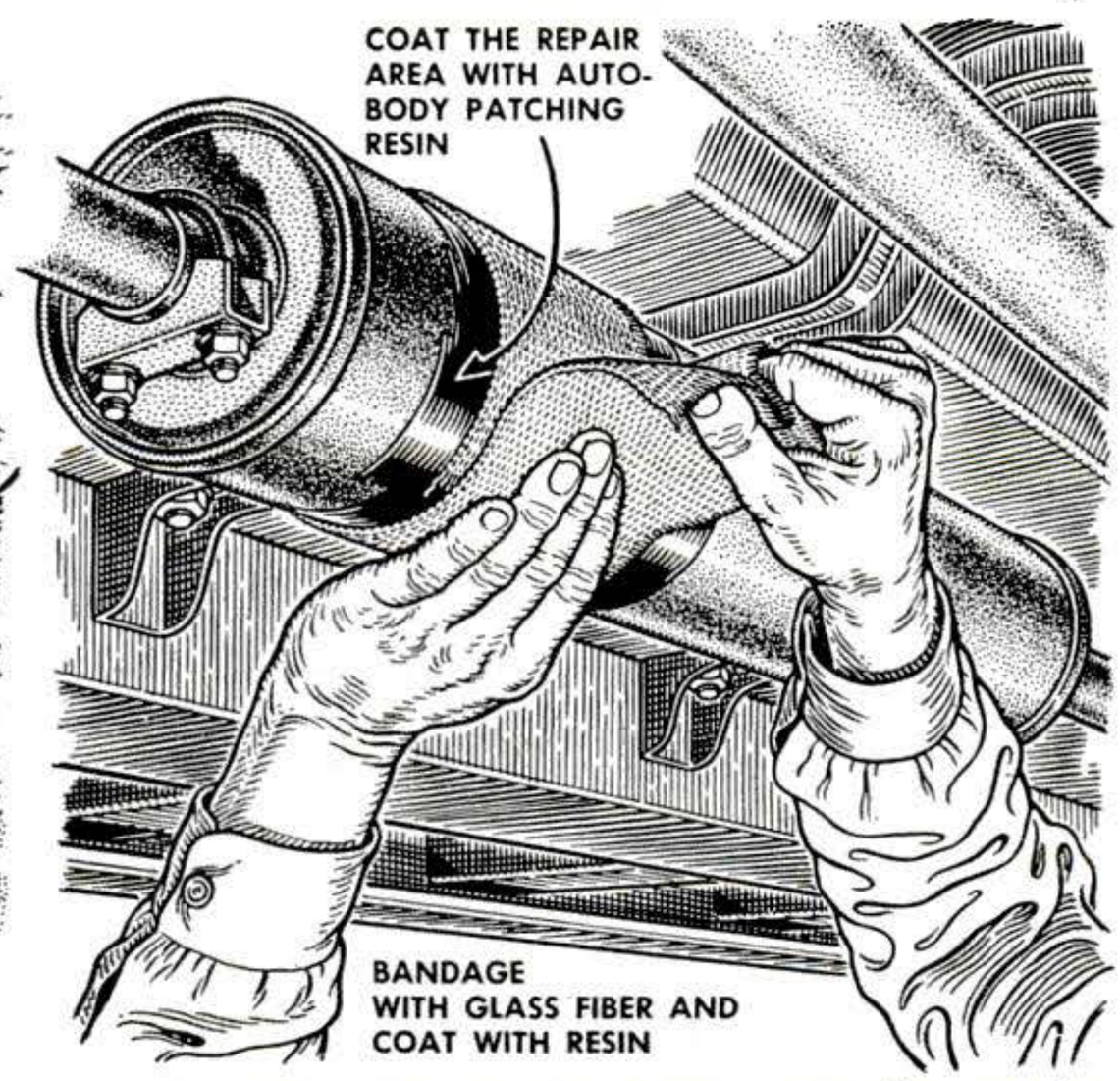
To check an oil filter quickly, feel the temperature of its housing after warming the engine. If the housing feels substantially cooler than the oil pan, the cartridge is dirty and oil is bypassing it. Change it as soon as possible.



A horn wire that's frayed where it enters the steering column can cause the horn to blow when you turn the wheel. Slit a plastic soda straw and slip it over the wire to cover the frayed spot. To hold the straw, tape it to the wire.



Buying a used car? Look closely at the figures on the speedometer. If the first three digits are not in perfect alignment, you can suspect the mileage has been set back. Try to estimate the *true* mileage by the condition of the tires and pedals.



A permanent muffler repair can be made with a glass-fiber body-patching kit. Wire-brush the area around the damaged part and apply a coat of liquid resin. Then wrap a strip of glass-fiber cloth around it and saturate it with resin.

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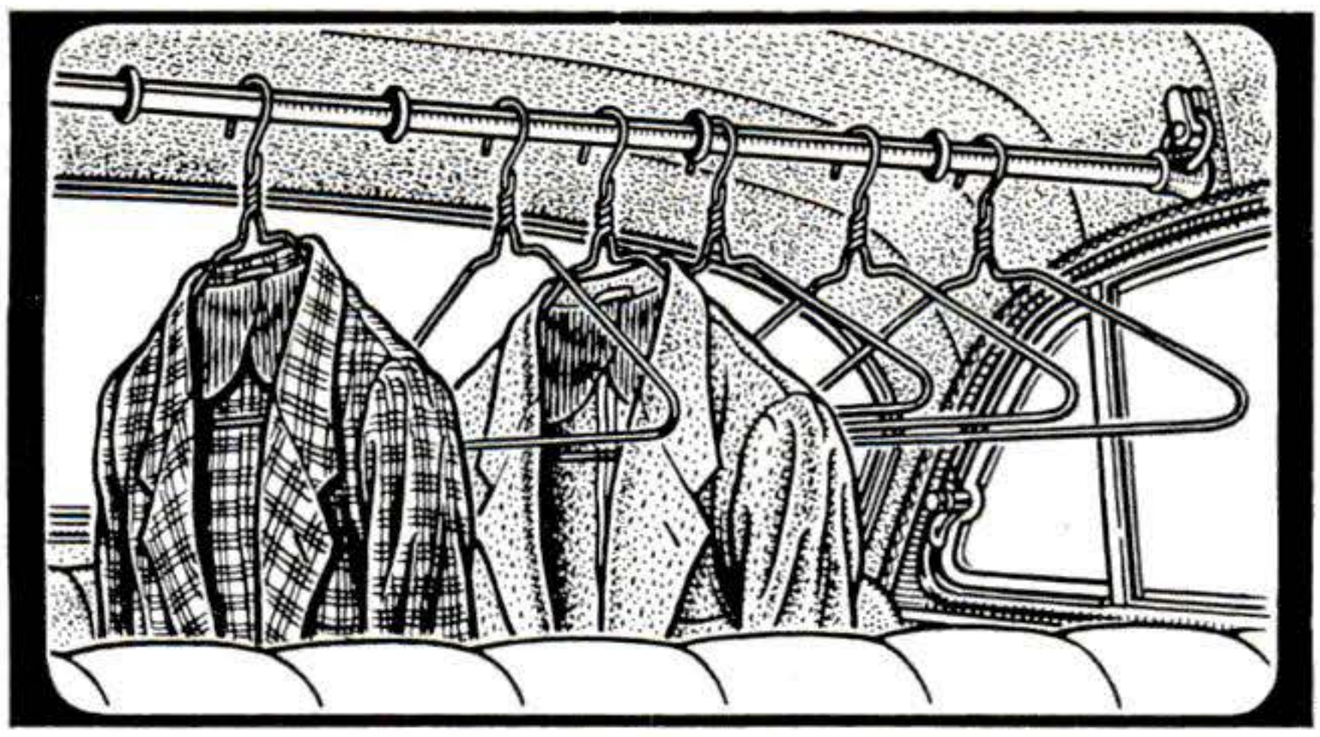
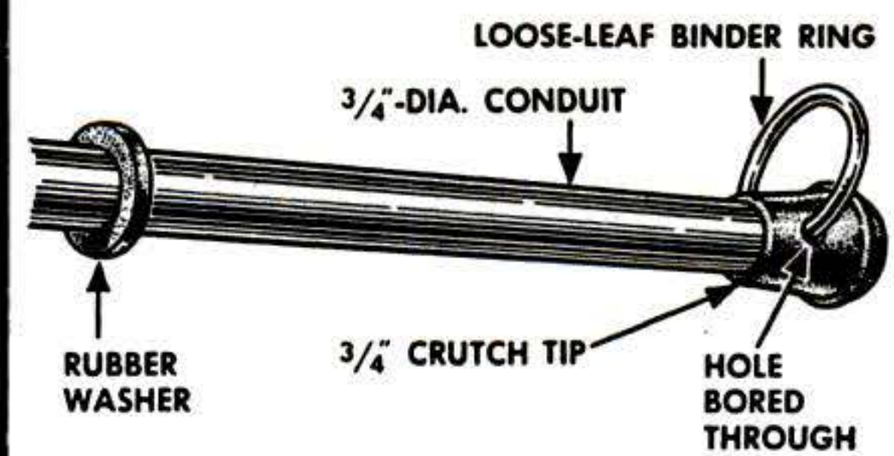
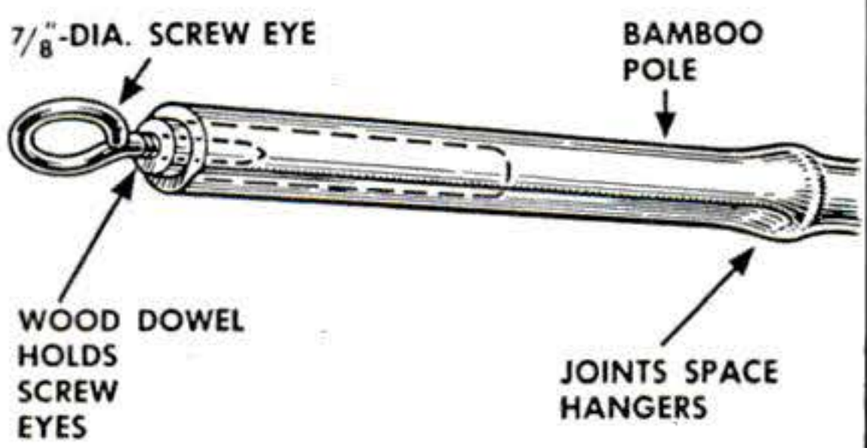
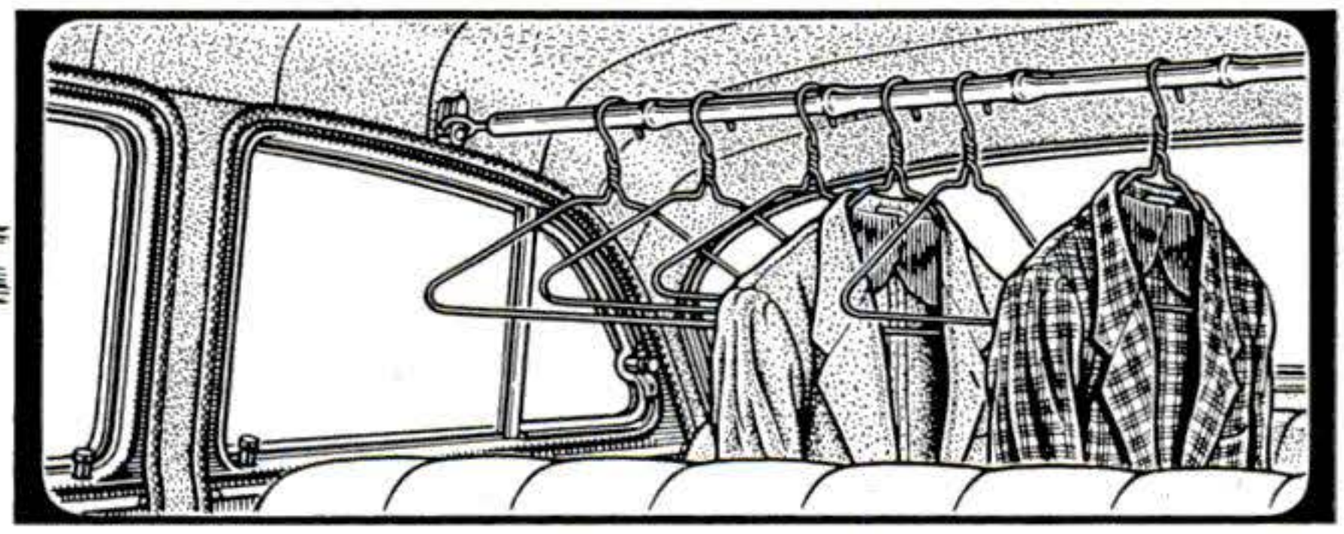
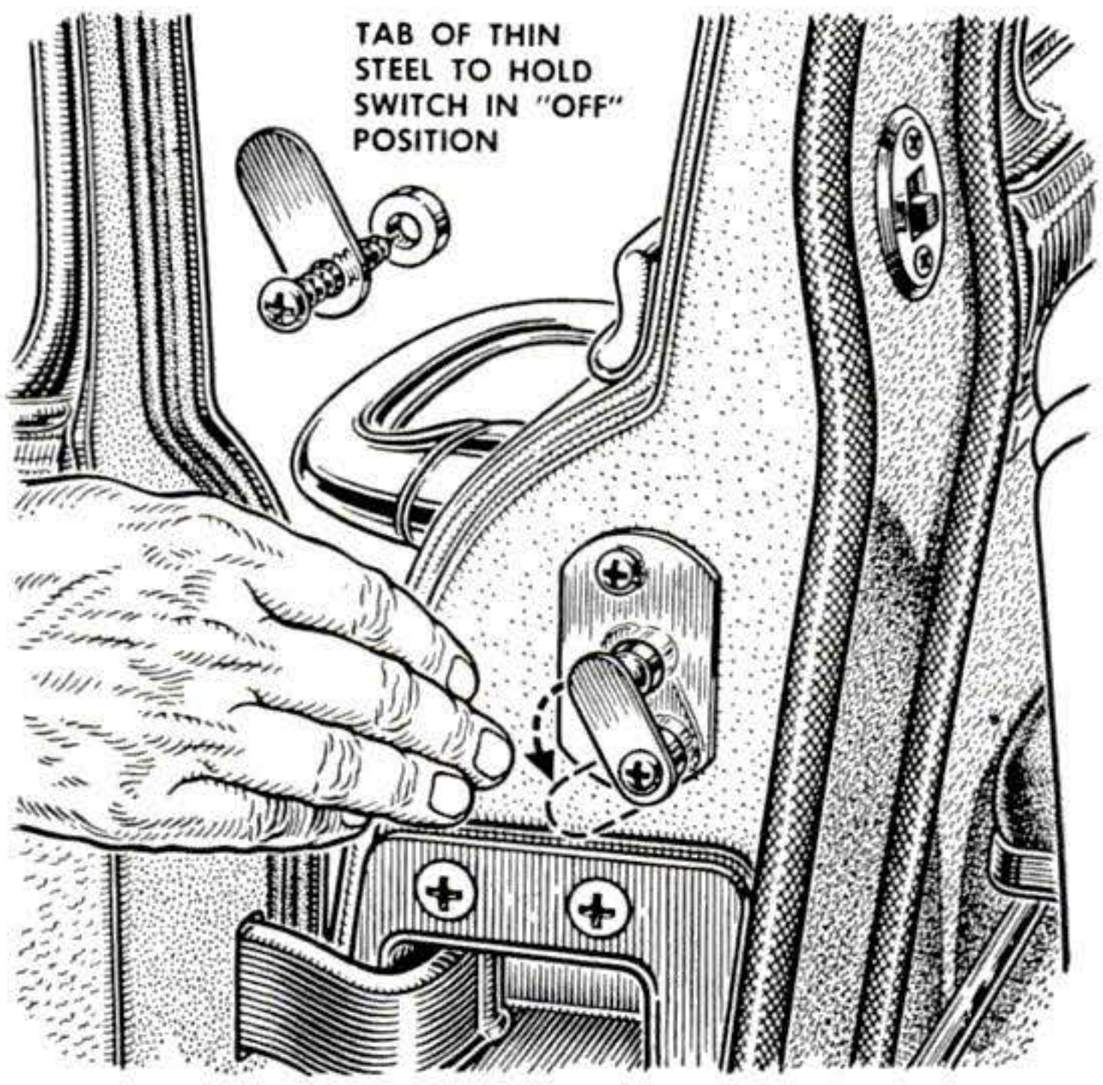




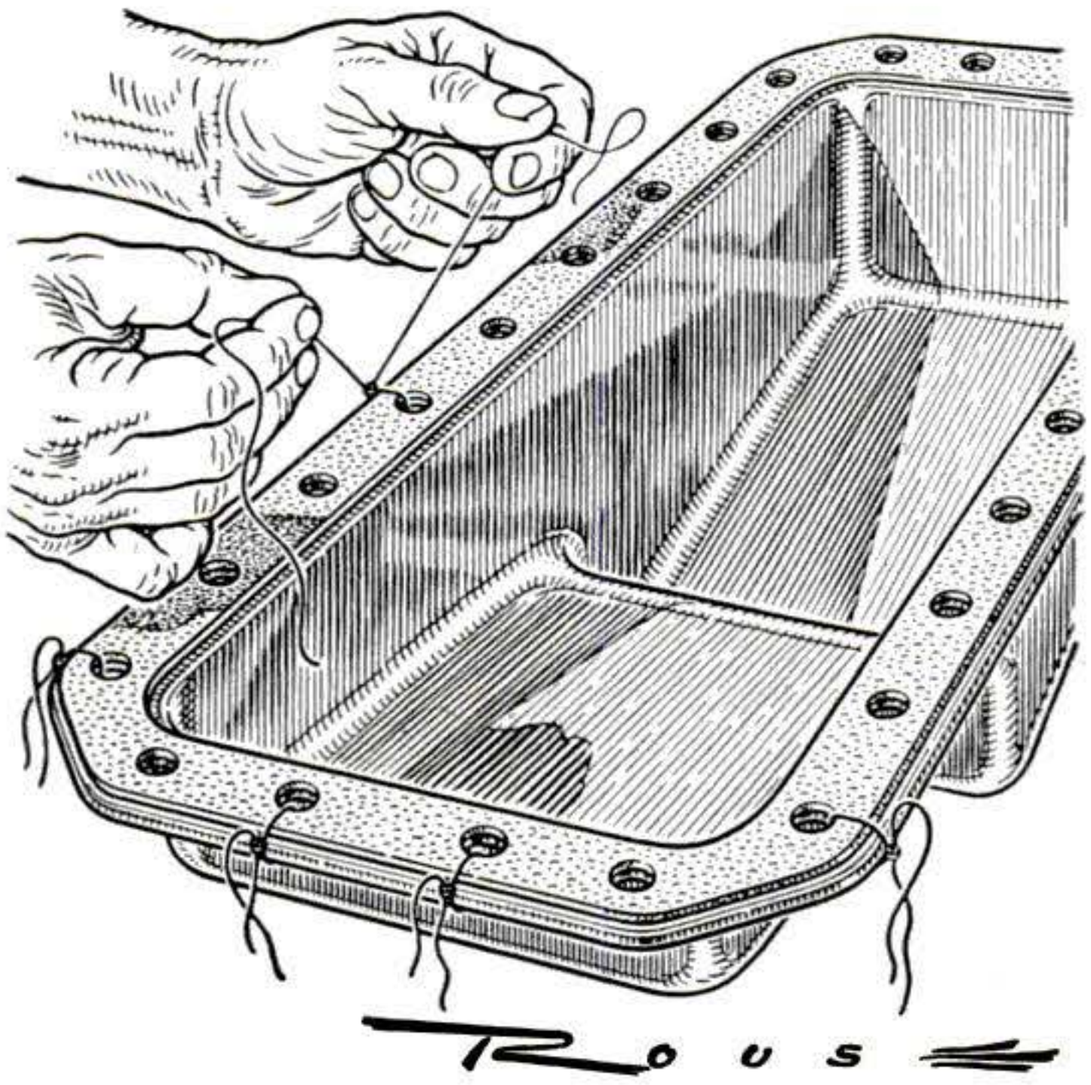




Garments stay wrinkle-free if you hang them on a bamboo pole or a length of conduit suspended between the rear-seat coat hooks. If bamboo is used, plug each end with a dowel and fit it with a screw eye. The knobby joints will keep hangers from sliding. On a rack made of conduit, protect the car by pressing crutch tips over the ends. Hang the rack on loose-leaf rings snapped into holes drilled through the ends. Slip hose washers on the conduit to space the hangers.



Sitting in a drive-in on a warm night, you can keep the car doors open without burning the dome and courtesy lights. Install metal tabs on the door switches and swing them over the switch buttons to hold them in the "off" position.



Tie a cork gasket in place with *light* sewing thread to keep it from slipping out of position during installation. The thread needn't be removed, as it won't interfere with the seal or the insertion of bolts. For neatness, trim off the free ends.

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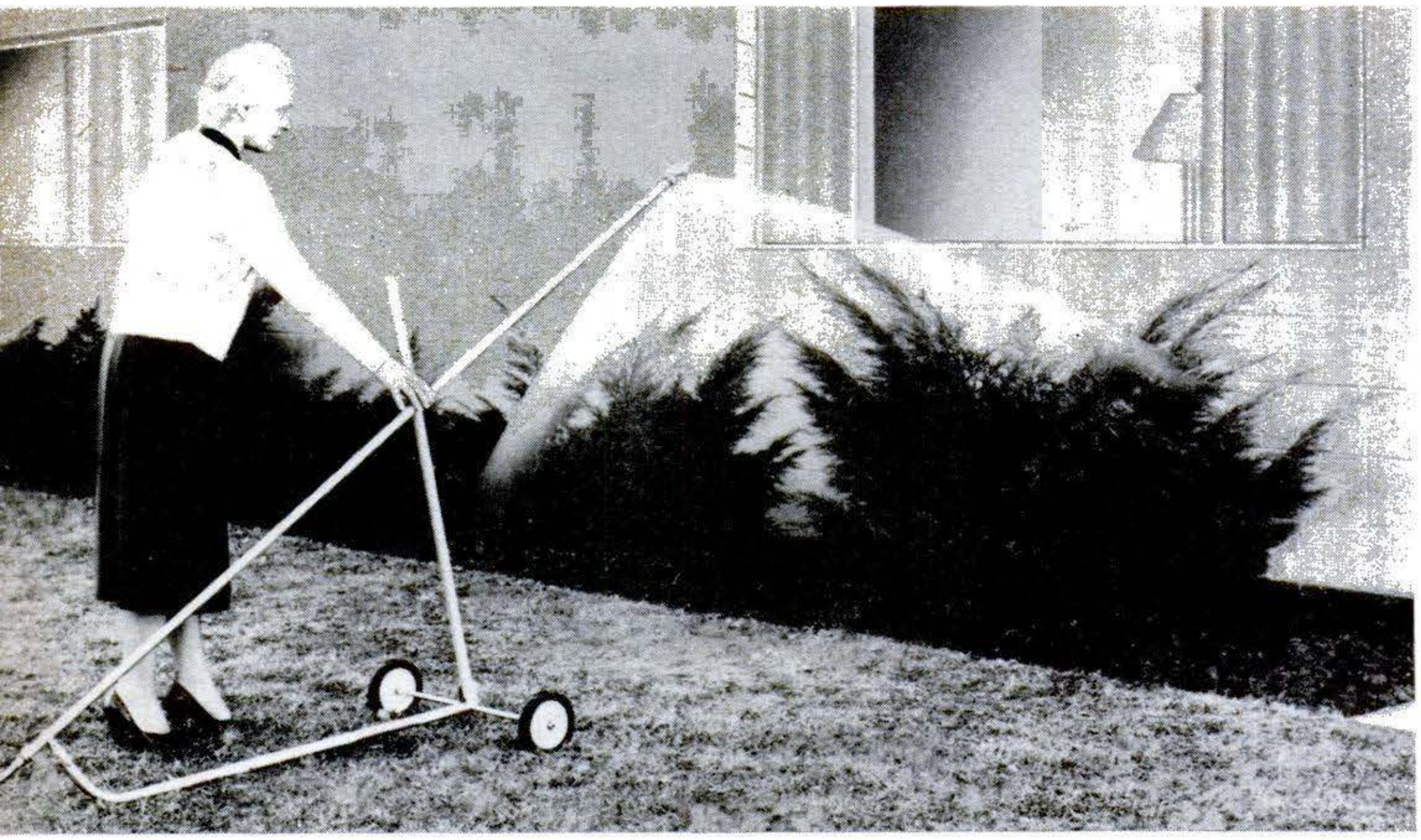
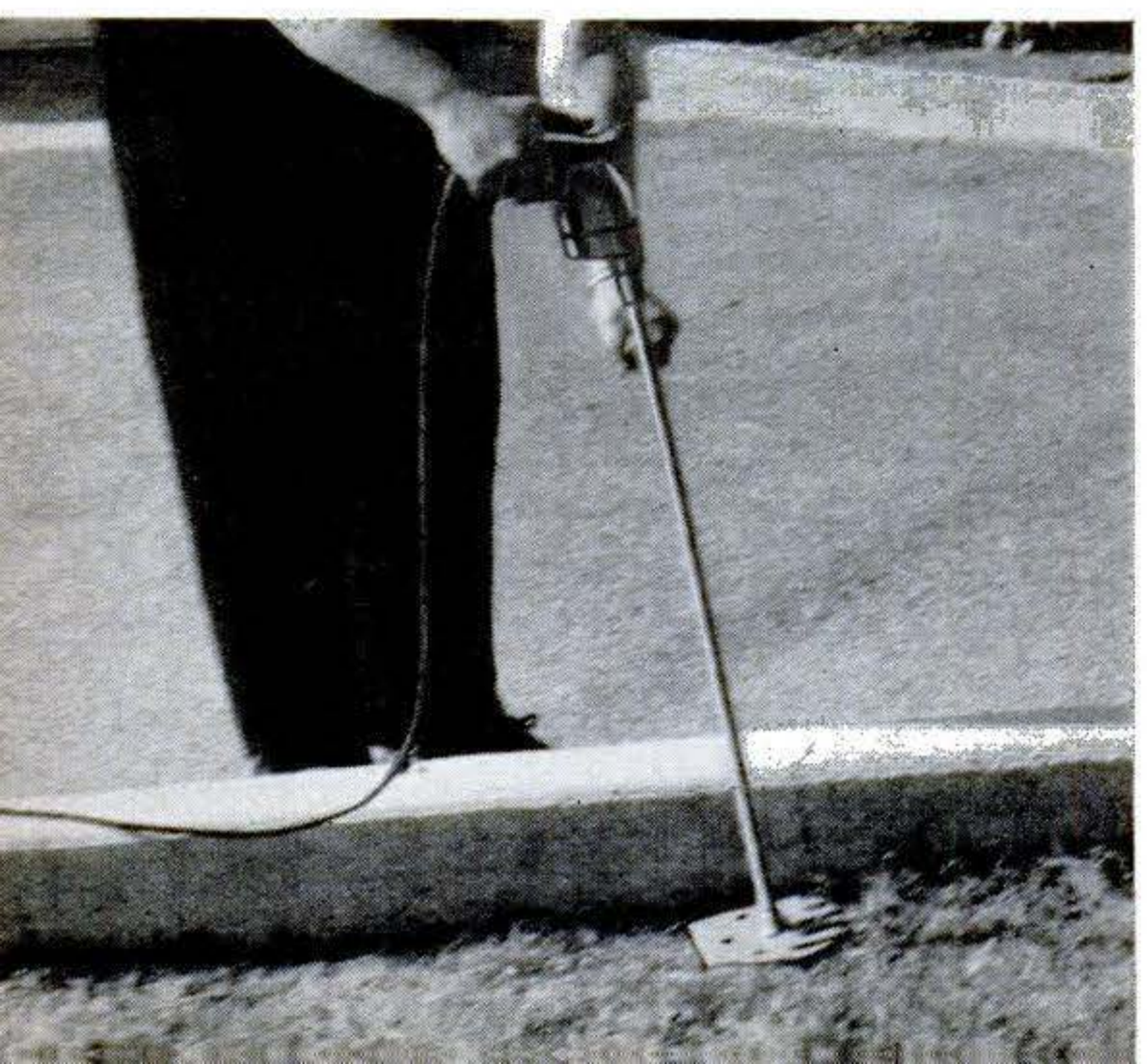
New Aids to Living



1 Water caddy gives a lift to a hose and adds seven feet to its reach. A spring clamp takes standard hose nozzles and most one-piece, non-moving sprinkler heads. The rubber-tired caddy has an aluminum tubing frame, weighs less than nine pounds and will fold flat for hanging in a storage area.

More information *about the products shown on this page can be obtained from: 1. Clark-Feather Mfg. Co., Fort Morgan, Colo.; 2. The S. J. Wegman Co., 35 Wilbur St., Lynbrook, N. Y.; 3. O. E. Linck Co., Inc., Junction Routes 3 and 46, Clifton, N. J.*

2 Rotary lawn edger draws power from any ¼-inch or larger electric drill. Steel fingers comb through the grass, and four revolving blades beneath them snip it short as you walk alongside curbings and fences. The steel drive shaft can be adjusted for convenient length.



3 Liquid spreader rolls over a lawn spraying fertilizer, fungicide or weed killer to keep grass healthy. A hose pump on a one-wheel drive keeps the liquid flowing evenly. As the wheel turns, rollers move along the hose, forcing the solution through the clog-free nozzle.

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Working with brick, block, stone and tile is easy when you know—

The Secrets of Masonry Cutting

By Ralph Treves

YOU can cut brick, concrete block, flagstone and tile just as accurately as a professional mason. It will take you longer, of course, to get sure, clean cuts, until you get the feel of each material and learn to reduce work to a minimum. But the basic principle is as simple as that of sawing wood.

You don't use strong-arm methods here. You merely help along the natural tendency of masonry materials to cleave along a line of least resistance.

For all cutting jobs, the trick is to score the surfaces where you want the break to come. This alters the internal stresses at the cutting line and, barring some hidden flaw, a final sharp blow will

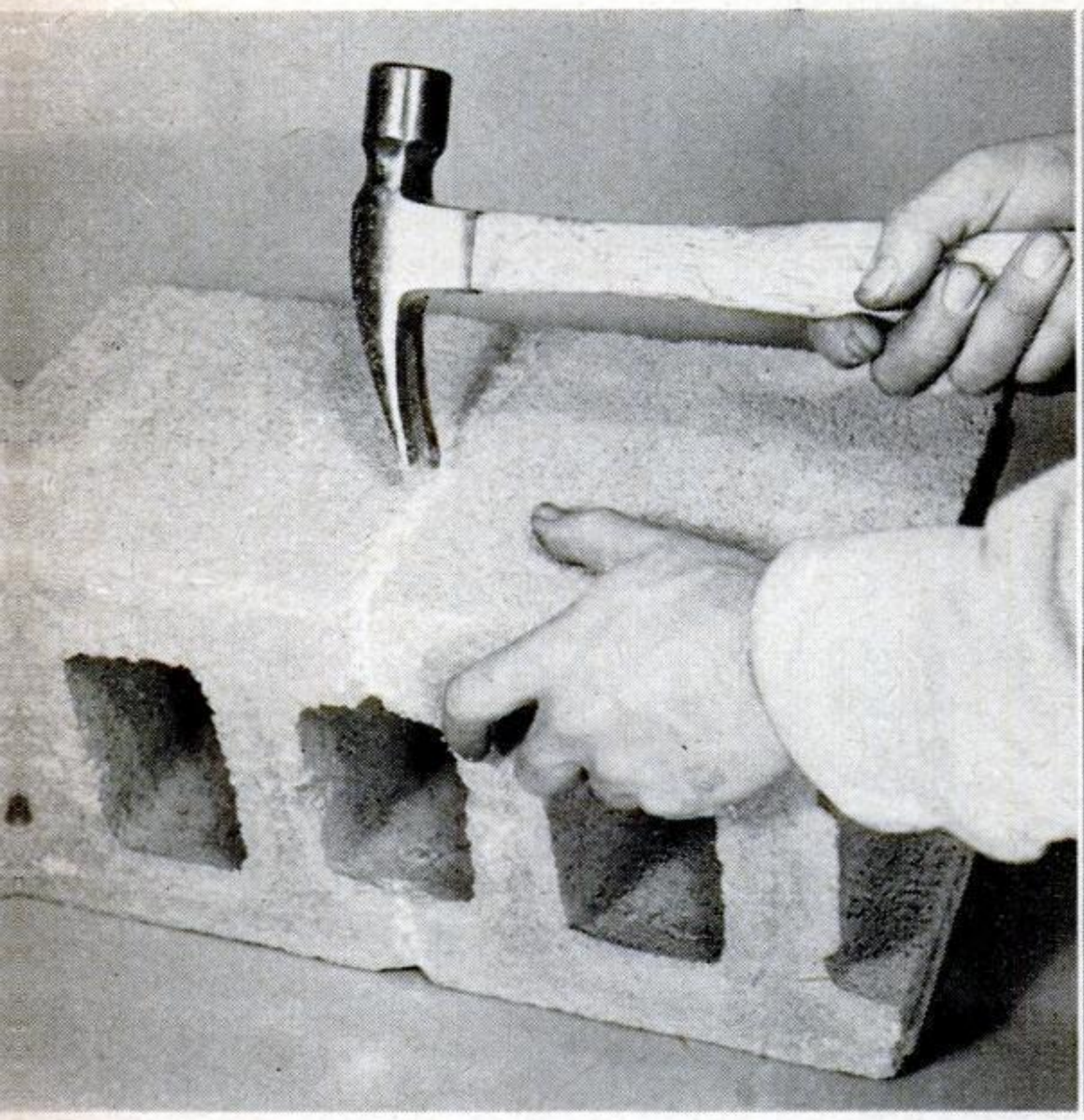
TO CUT DRAIN TILE, place it on soft earth and rotate it while you score the cut line with light hammer taps on a sharp cold chisel. Continue several times around, gradually increasing the force of the hammer blows until the pipe parts.

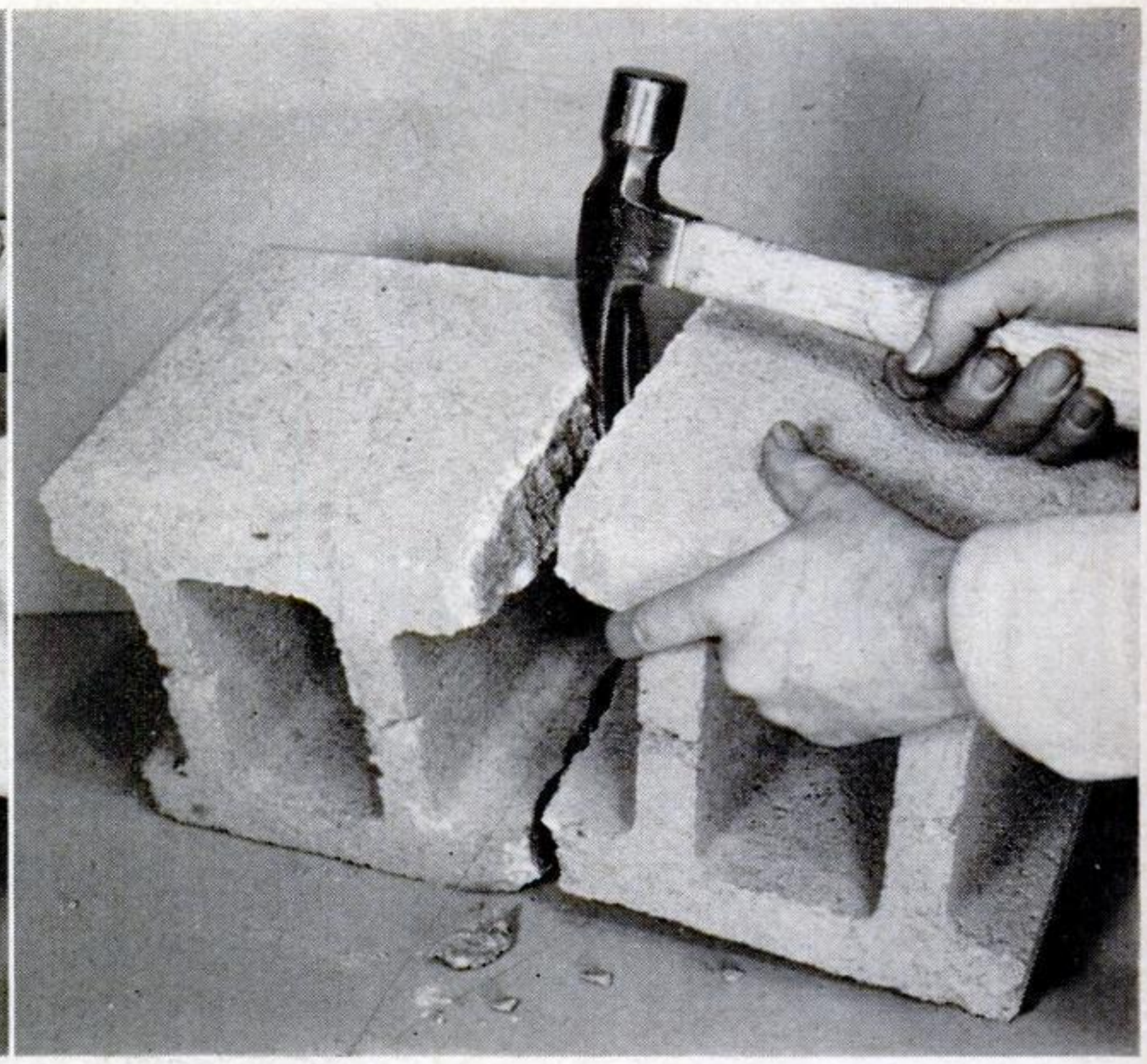
Copyrighted material

give you a cut that follows the grooves.

Supplementing this cutting method, you can often use two allied trimming operations—chipping and nibbling—for fitting thin materials such as flagstone and ceramic tile. Again, don't use brute force. Leverage, with a fulcrum applied to the cutting line, does the job.

Pictures here and on the following pages show you the pros' techniques.





Here's how to cut concrete blocks

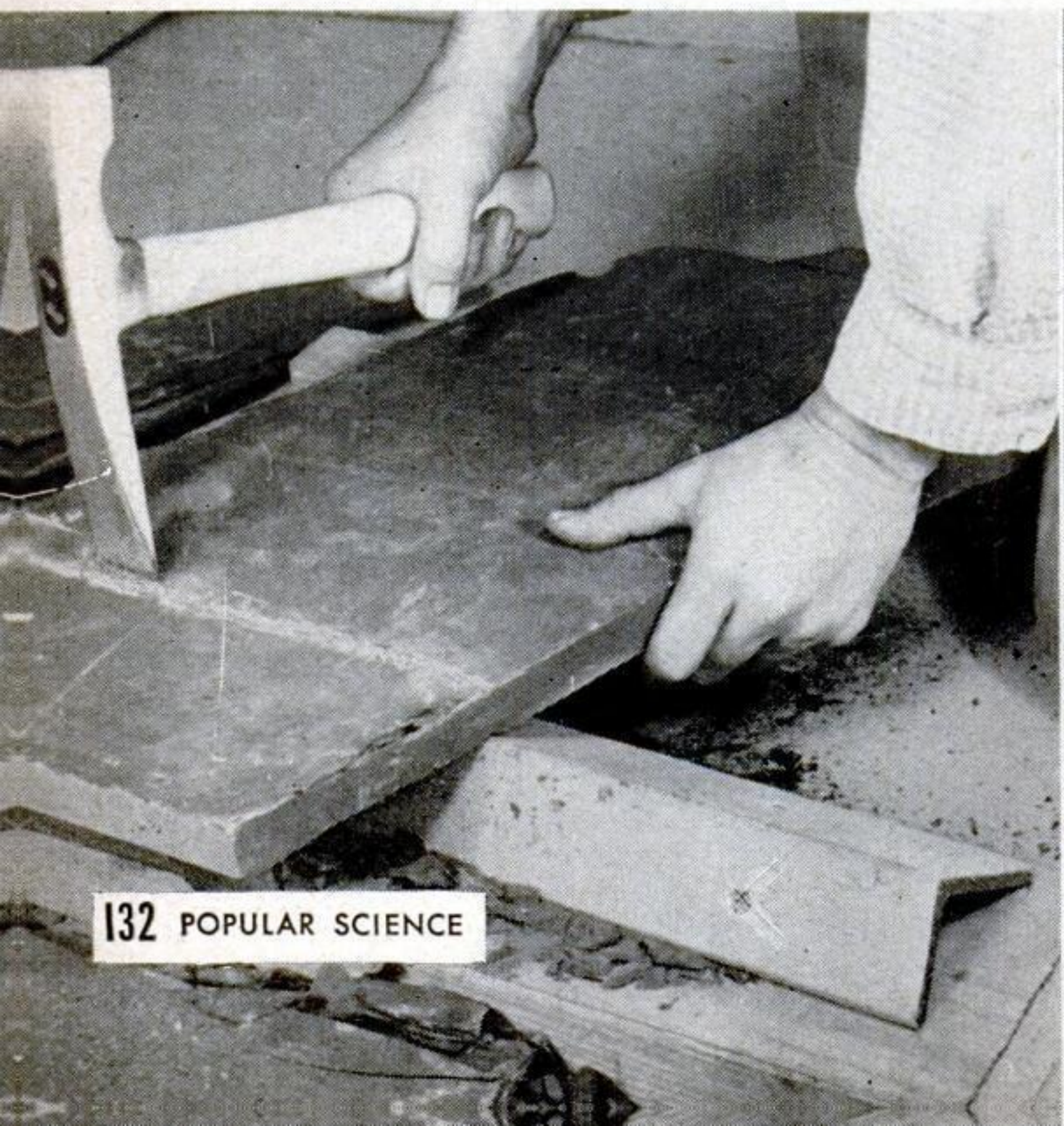
USE THE CLAW END of an ordinary hammer, or a sharp cold chisel, as a cutting tool. Score both the faces and the edges of the block with repeated, light blows. Continue until the grooving is approximately 3/8" deep.

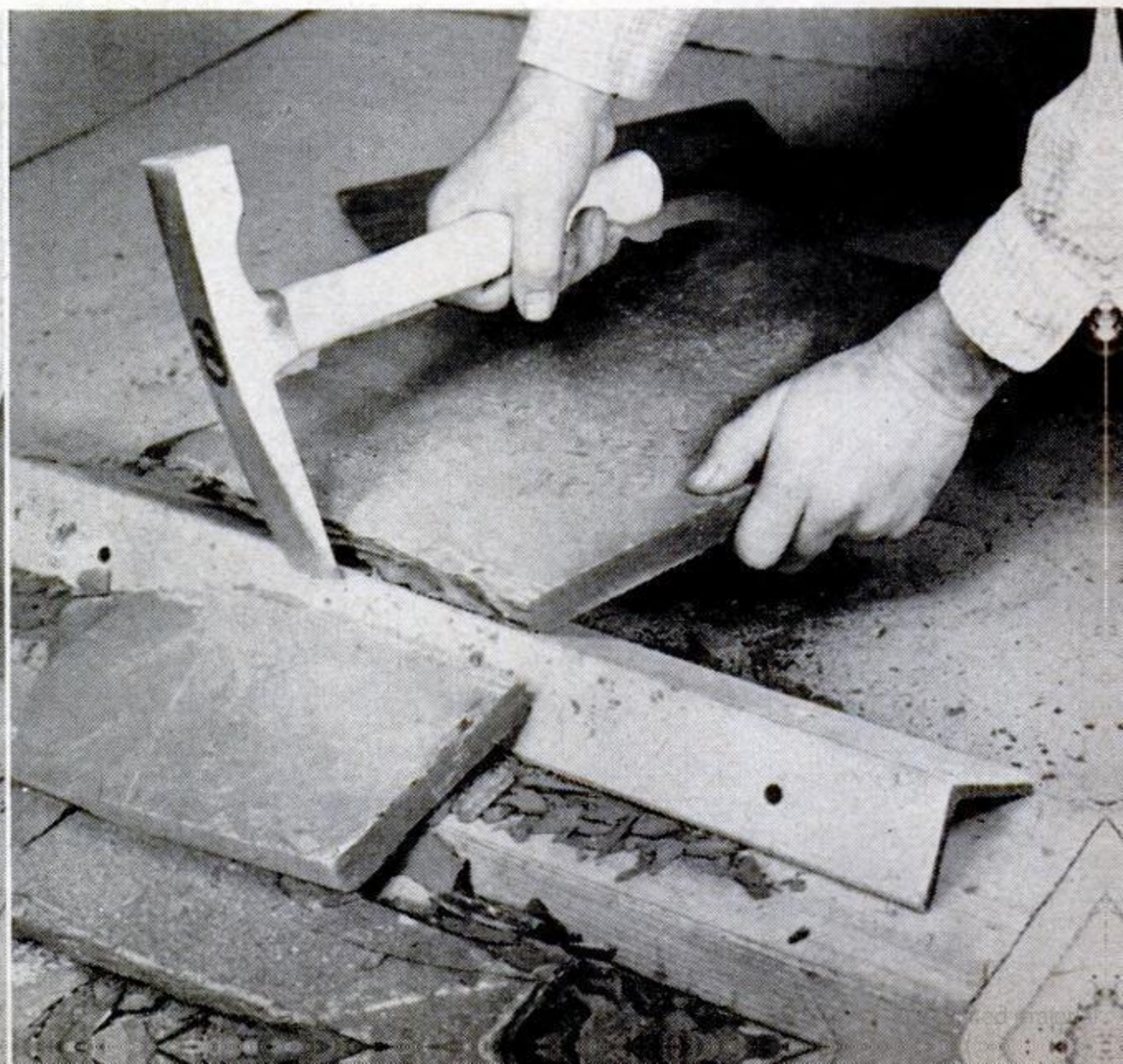
FINAL SHARP BLOW at the center of one face parts the block cleanly. Never lay either blocks or bricks on an irregular surface when you are cutting them. A level bed of loose earth or sand makes a good backing cushion.

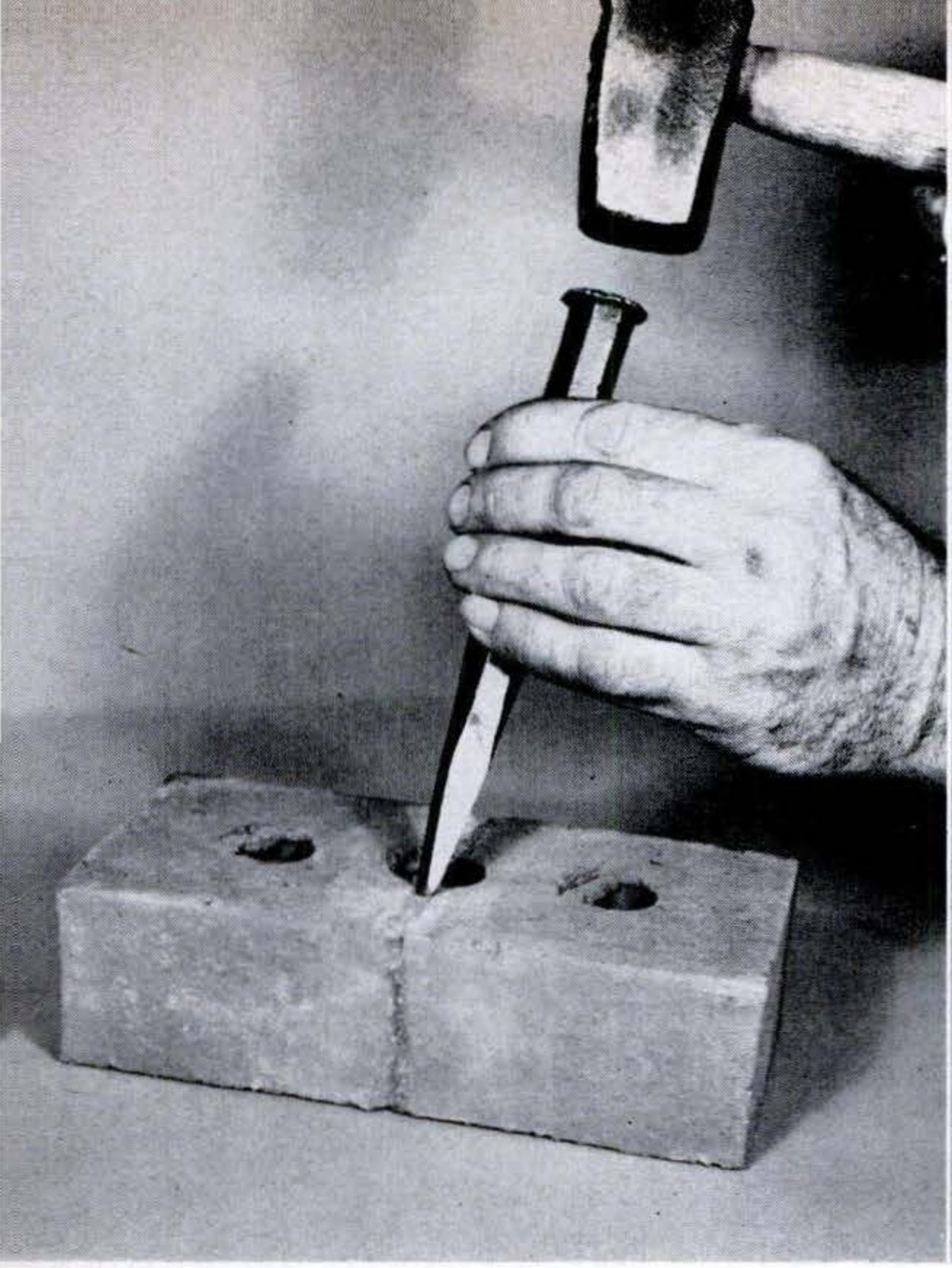
The right way to shape flagstones

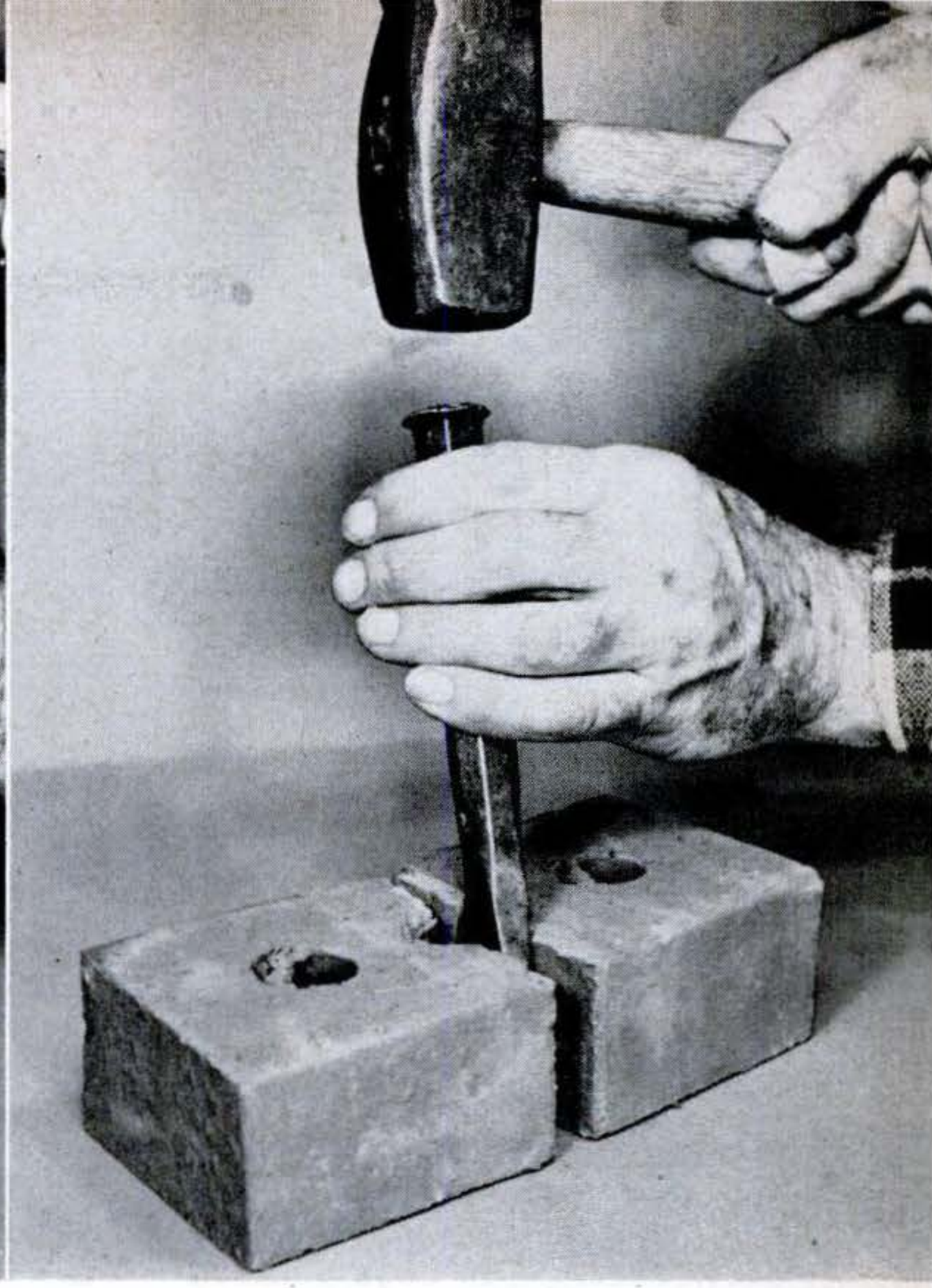
PLACE A FLAGSTONE to be cut face upward on an angle iron. Align the chalked or crayoned cutting line on the slab with the angle iron's apex. Work back and forth along the cutting line with a stonemason's adze.

CONTINUE DEEPENING THE GROOVE as uniformly as possible until the flagstone parts. If its underface has been kept in firm contact with the edge of the angle iron, the stratified slate won't break away behind the cutting line.









Use this method to cut bricks

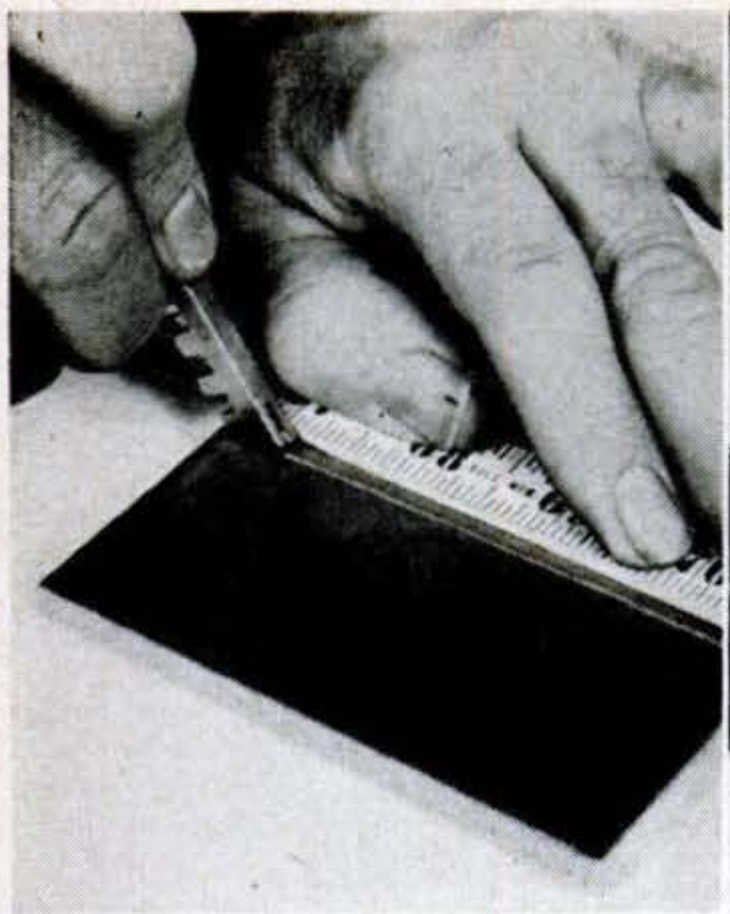
WITH A SHARP COLD CHISEL, score all four sides of the brick at the cutting line. The scoring needn't be deep—one blow at each chisel position is enough. But be sure that you make the groove continuous around the faces.

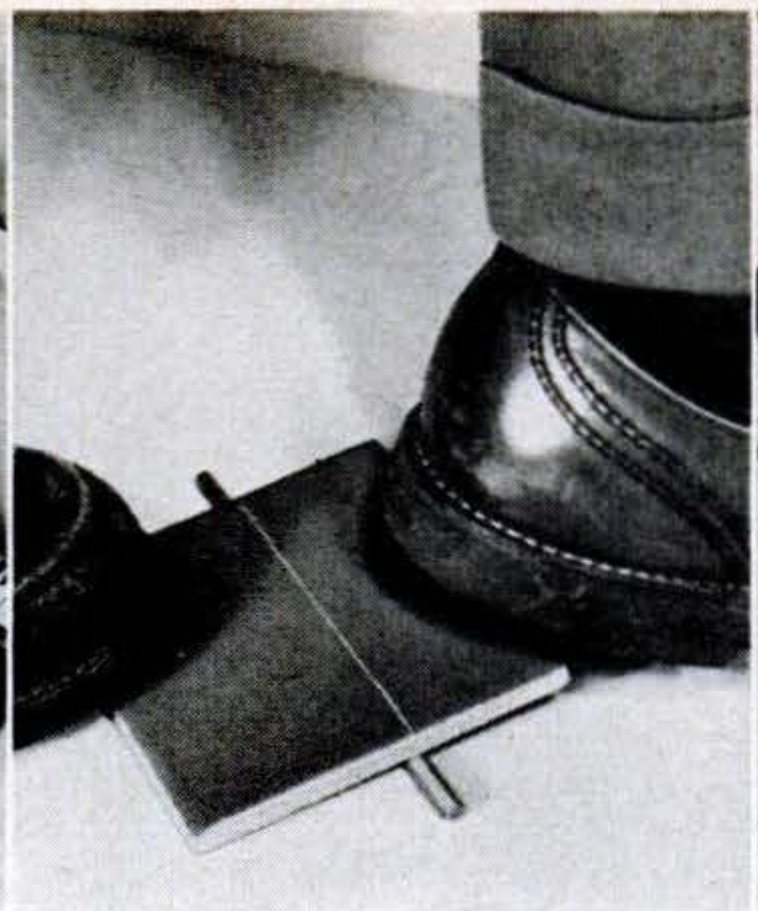
AFTER GROOVING, place the chisel at the center of a wide brick face and give it a sharp hammer blow. Parting will follow the grooves. To halve a cored block, apply the parting blow to one side of the void (as shown above).

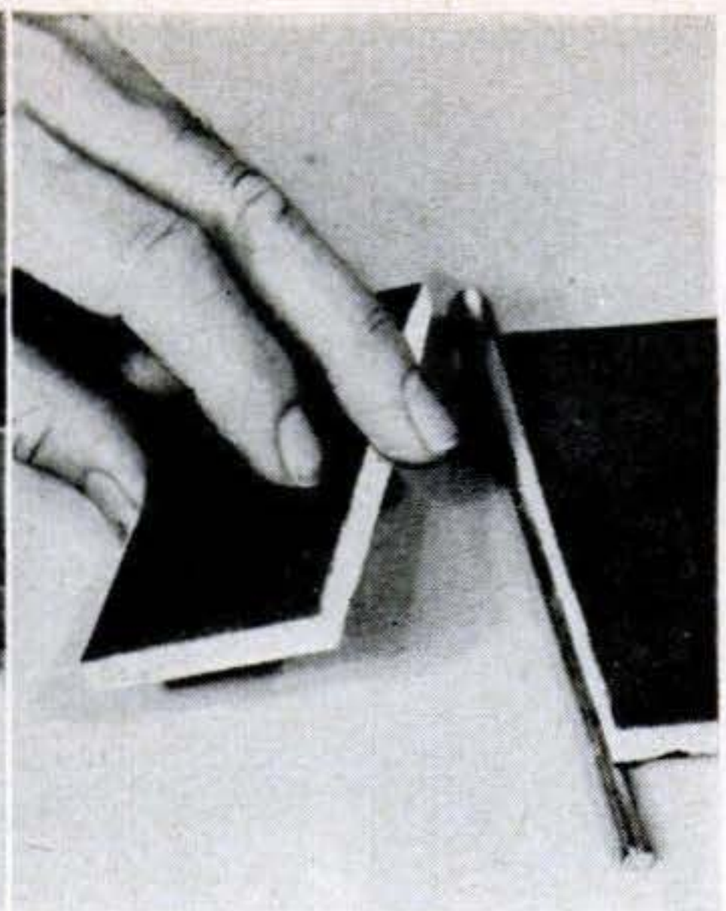
TO TRIM A FLAGSTONE, place the edge to be doctored above the angle iron, with just a slight overhang. Chip off this overhang; then advance the slab and repeat as often as necessary, until you have reached the cutting line.

SCORE A CAST-CONCRETE FLAGSTONE all around at the cutting line. Make grooves a bit deeper at corners to prevent breakaway. Part the slab with a blow near the center of one face, as shown below. [*Please turn the page*]

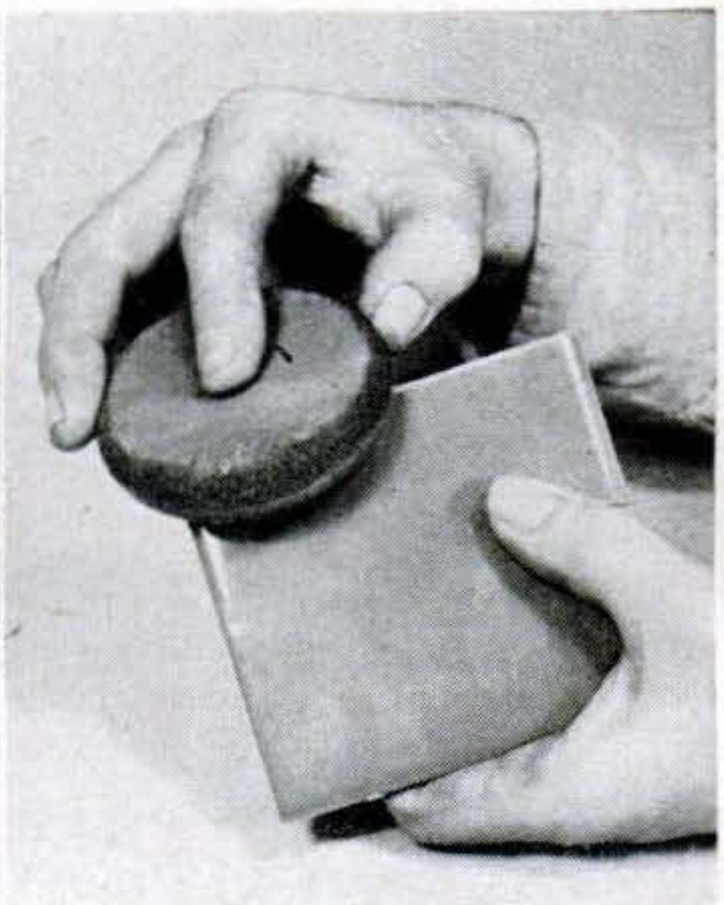
These cutting tips tame tough, glazed tile







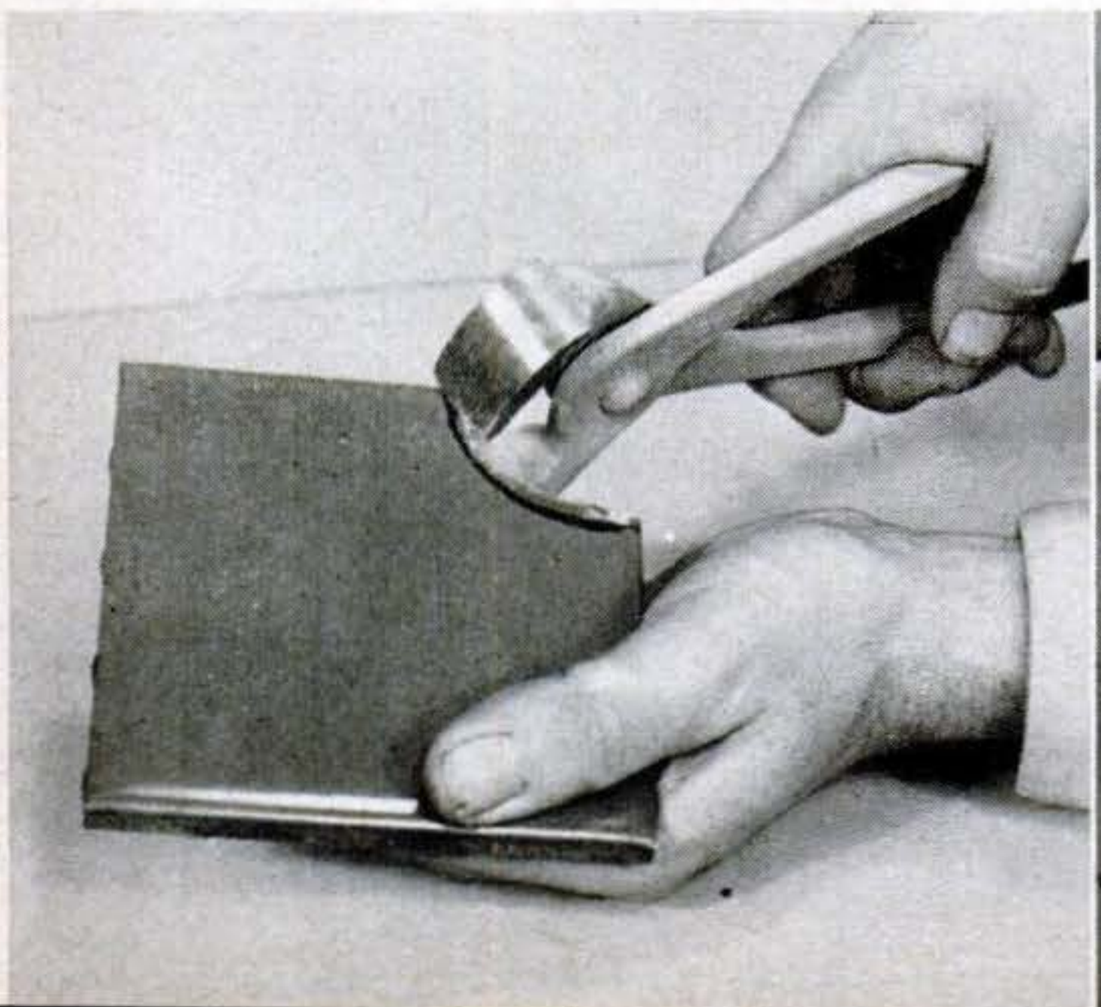
WITH A SHARP GLASS CUTTER (use a carbide-tipped cutter if many tiles need to be parted) scratch deeply and evenly into the tough tile glaze. Place the scored tile on a heavy rod or bolt and, holding down the larger tile section with the sole of one shoe, press on the raised section with your other heel. The result is a cleanly broken tile at the scored line.

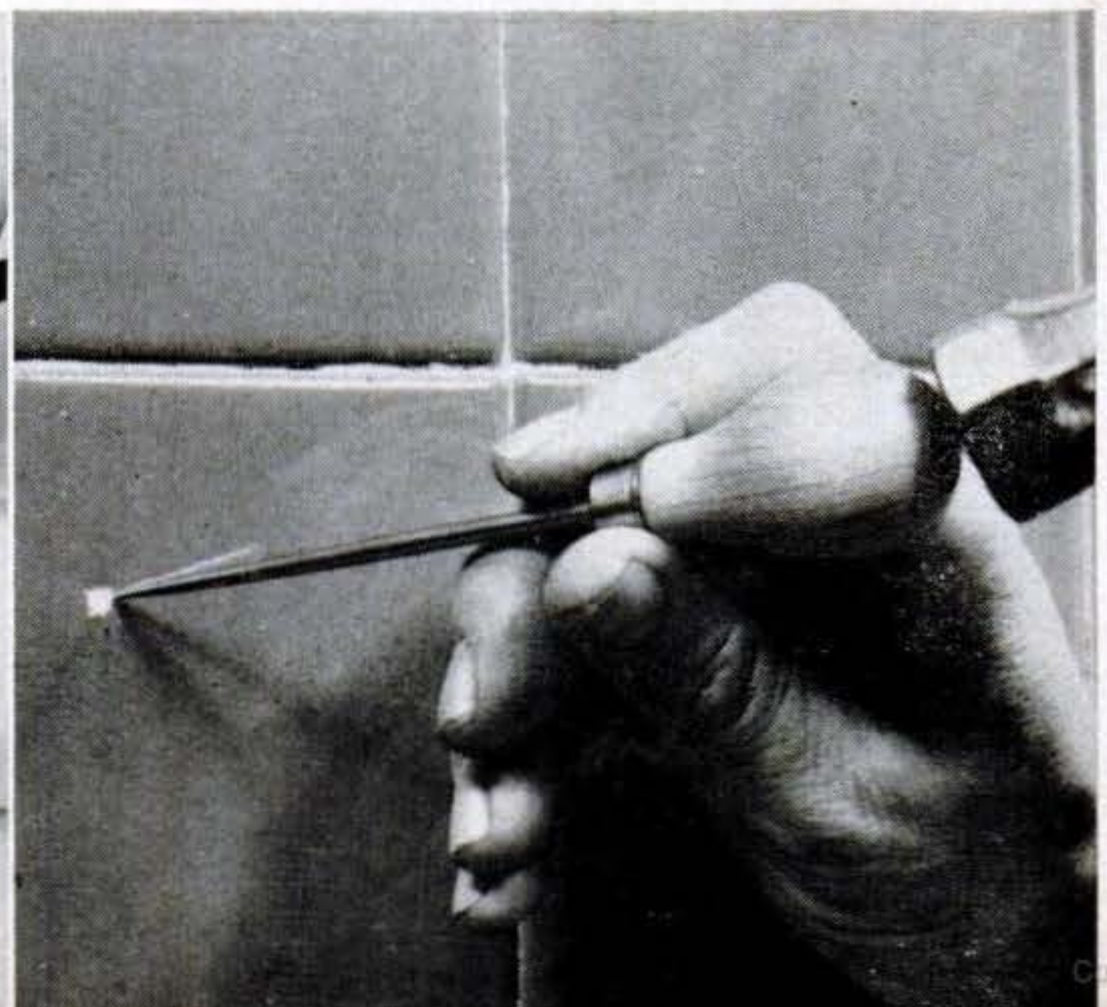


FOR NARROW CUTS, scribe the tile face to prevent chipping the glaze. Then use nippers (preferably 8" or larger for good leverage) to chew off excess material. Take shallow bites, gripping the tile firmly in the nipper jaws and levering the handles down with a tearing action. Smooth the tile edges on a grinder. For beveling, use a carborundum stone.

CUTOUTS FOR PIPES and abutting moldings are also made with nippers. Work in to the cutting line bit by bit. To save time on a cutout like the one shown below, first break off a corner of the tile along a diagonal scratch line.

IT'S EASY TO BORE HOLES in tile with a carbide-tipped drill. First scratch the glaze in the area to be drilled, using a sharp awl or glass cutter. This lets you seat the drill firmly and prevents crazing of the tile surface. END





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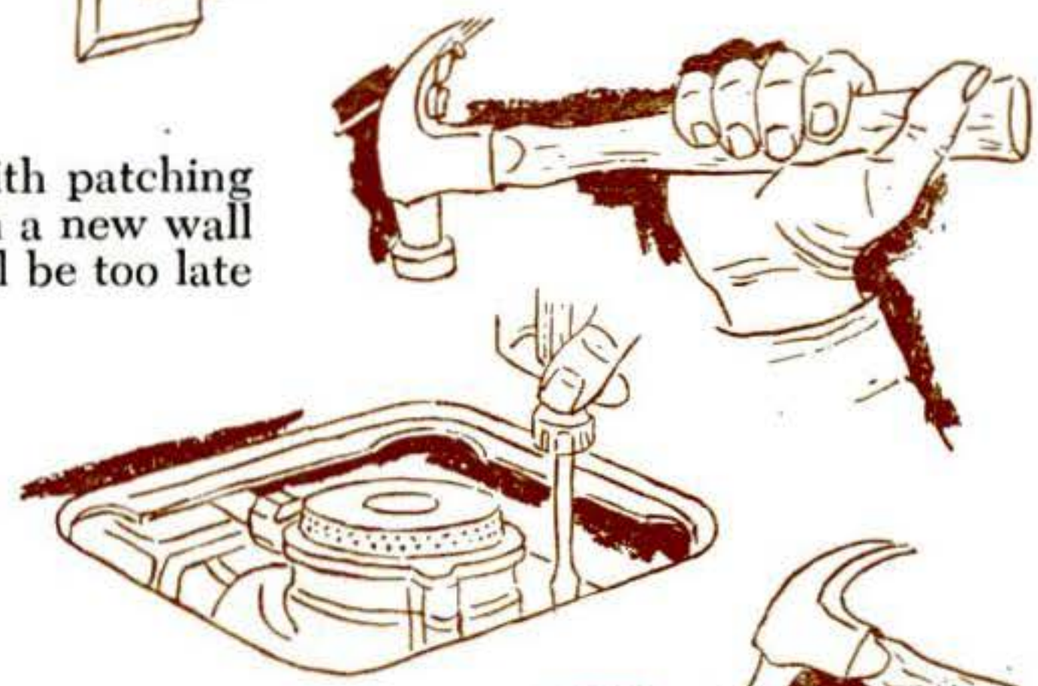
10 Painting Tips

REMOVE PLATES from light switches and wall outlets before painting. Besides giving you a neater job, this will keep the paint from chipping away from the edges of the plates if they must be removed later to permit electrical repairs.



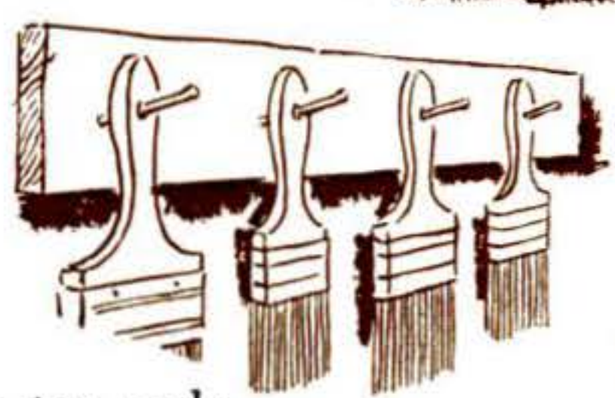
TAKE DOWN PICTURE HOOKS, fill the holes with patching plaster and sand the patches smooth when dry. With a new wall color, you may want to rearrange the pictures. It will be too late to fill in the old holes after you have painted.

WHEN PAINTING A KITCHEN, be sure to turn off the pilot burners in the range so that the range can be safely protected with a drop cloth or newspaper. A good safety rule: Open the windows to ventilate any room while you are painting.

PUNCH FOUR OR FIVE HOLES in the rim of each paint can that you use. This will allow paint to drain back into the can after each brush-dipping. When the lid is tapped back in place on the can, it will cover the holes and keep the can sealed.

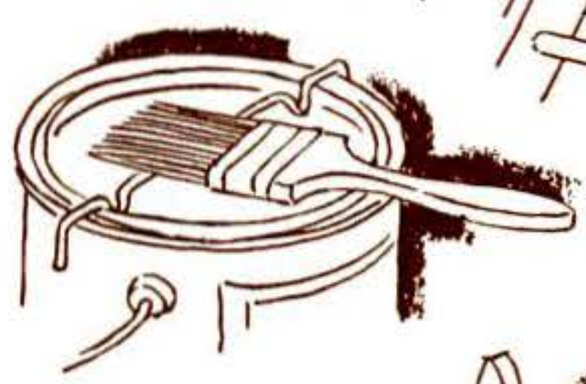
WHEN TAPPING LID ON CAN, put the lid in place, then cover it with a cloth to keep any paint remaining in the groove from being spattered out with the hammer blows. Wipe the can clean and dispose of the rag *outside*, preferably by burning.

AFTER PAINTING, rinse brushes in thinner to remove most paint, then wash them with soap and warm water before they dry out. Rinse them with clear water and hang to dry. Save the thinner. After the pigment settles it can be re-used.

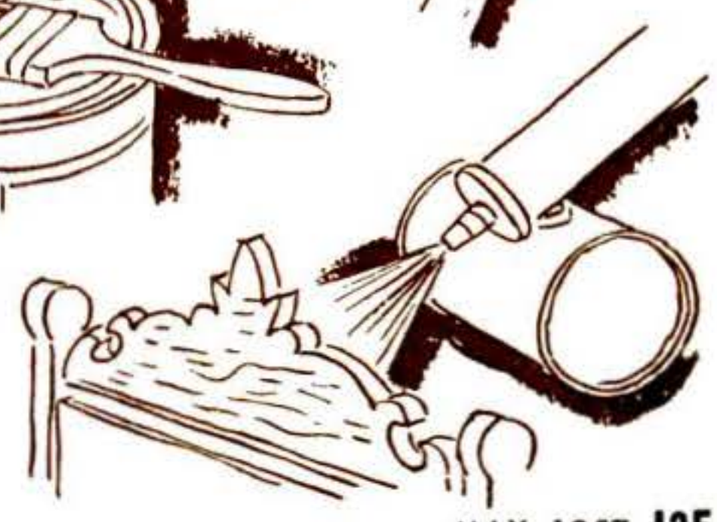


STORE BRUSHES BY HANGING, even if they're dry. Drill holes in handles to hang them on nails or to keep them suspended in thinner. Allowed to stand on end, the bristles will take on a permanent curl that will make painting difficult.

SLIP AN OLD PAIR OF WOOL SOCKS over the top ends of a ladder that leans against a wall while it is used for painting. The heavy socks will cushion the ladder and keep it from marring asphalt shingles or scratching fresh-dried paint.



BEND BRUSH HOLDERS from coat-hanger wire to fit different size cans and snap them in place across the top of the can. The wiping wire keeps the can clean when brushes are dipped and the projecting frame holds them, lets paint drip into the can.



APPLY PAINT REMOVER with an insecticide sprayer. It lays the remover on in an even coat and gets into moldings and crevices. As the surface of the old finish softens, it will absorb still more of the sprayed-on remover.

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ATLAS FIRESTONE GATES GENERAL

What Smart Tire Buyers Should Know

By Joseph Kuebler and Edward D. Fales Jr.

WHAT kind of 1957 tires are you going to buy? It's a complex market this year. The careful shopper must answer such questions as:

- Should you buy rayons or nylons?
- Should you switch to tubeless if you're still in the tubed class?
- What about cross-slit treads? Steel treads? Inner tires? Self-sealers?
- Should you choose "first-line" tires or money-saving "second-liners?" Should you explore the premium class?

Now is a good time to buy, whatever tire you choose. There are two reasons: (1) the first of the three big annual sales is on during May; (2) tires installed in spring have a chance to break in on cool roads before tackling blistering-hot summer turnpikes. An easy break-in makes a tire last longer.

The time to start looking for a new tire is when your old one still has from $\frac{1}{8}''$ to $\frac{3}{16}''$ of the tread depth left. (Tread depth on new tires is about $\frac{11}{32}''$.) At this point, your tire is becoming less safe. Further wear may damage the inner carcass and destroy its trade-in value.

Rayon or nylon? That's the big question this year. Rayon has been getting steadily tougher. Since World War II rayon cords have been used in place of cotton to weave the vital carcass that lies under the rubber treads. Most cars coming out of Detroit have rayon tires.

However, nylon is coming along fast. This year one new passenger tire in every eight is nylon. Furthermore, nylons have come down from the high-premium class. Last year they cost 20-22 percent extra. This year you can buy a 6.70 x 15 nylon for only about $1.50 more than a rayon.

Here's how to choose. Go to a dealer you trust. Tell him: (1) how fast you drive; (2) whether you carry big loads, a large family, or heavy equipment; and (3) what you use your tires for: Shuttling around town solo? Taking a small family to the movies and on an occasional trip? Or for hard road-pounding day after day?

For average family use, a reliable dealer will tell you that rayons are an excellent choice.

For long, fast runs day after day, the experts recommend nylons. They run cooler on hot roads (which destroy tires). And there is less chance that you'll be riding on a carcass broken when you rammed a curbstone two weeks ago.

You should know, though, that nylons have "morning sickness." They get a flat spot after standing all night, and you may hear a soft thump-thump-thump for a while.

Nylon wears longer. DuPont, which

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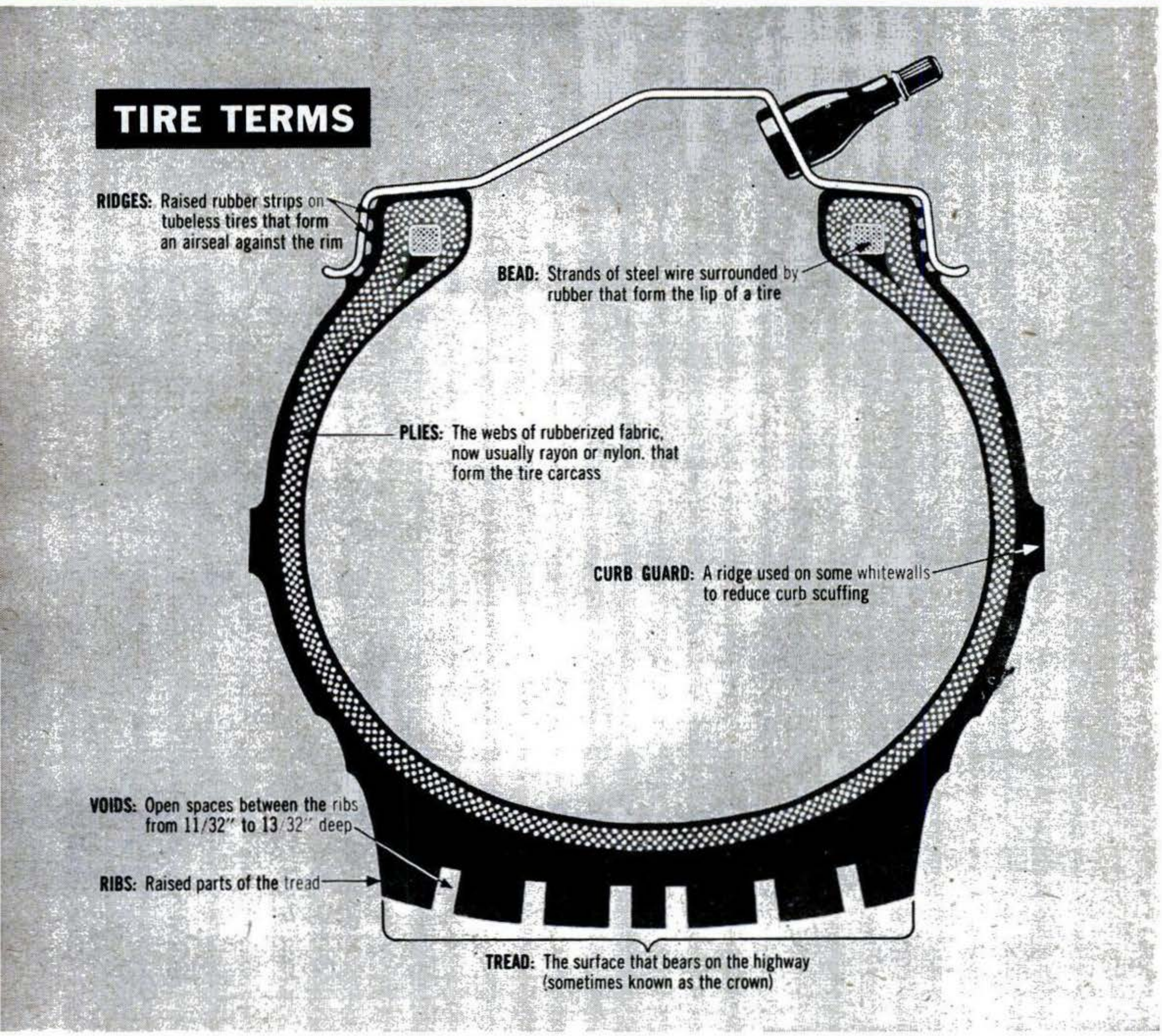
GOODYEAR SEIBERLING U. S. ROYAL



sells both rayon and nylon, gives the nod to nylon. It issued this report:

In Wilmington, Del., the City Cab Co. tested 27 nylons and 28 rayons. All were four-ply 6.70 x 15s, with inner tubes. After 100,000 miles—

Rayons still in use: 0.

Nylons still in use: 19.

Of the rayons, 16 had impact breaks. Of the eight nylons that failed, two showed impact breaks. The rayons averaged two retreads; but the nylons had taken four and were heading for a fifth.

If you want nylon, make sure the word "nylon" is printed on the tire. Otherwise your tire is a rayon.

Tubed or tubeless? You can take your pick. If you have a new car, chances

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are you'll replace tubeless with tubeless, although now and then you hear a driver say he's "going back to inner tubes" because he had tough luck with tubeless.

In the past, there have been "leakies," but Akron's tire makers say the bugs are pretty well gone. Detroit agrees, and tubeless tires are original equipment on practically all new cars this year.

If you drive an older car, its rims may have to be straightened, cleaned and buffed. The reason: The only thing holding air in a tubeless tire is the tight seal where the bead presses against the rim.

Are tubeless tires safe? Tire makers claim they're safer, because they run cooler and eliminate the inner tube. A tubeless casing, they say, greatly reduces the blowout hazard, although a tubeless will blow, too, if the carcass is broken.

First, second or third line? A tire maker calls his standard tire (the kind that comes on new cars) his "first line." It's also known as "100-level." Neither term has anything to do with national standards of quality (there are none). They merely represent the maker's own quality and price "horizon."

Above that horizon you can buy his premium tire—for as much as $60 more.

Below it, you can buy his second-line tires, which are about 80-level and sell for 80 percent of first-line price. You can even get third-line tires, which are another 10 percent cheaper. They're made by the large companies in a few popular sizes (6.70 x 15, 7.10 x 15 and 7.60 x 15).

For the money, second-liners of reputable make do a good job—for moderate driving. Third-liners may be all that's needed by a slow driver or senior citizen who shuttles around town.

Second-liners may run a few pounds lighter than first-liners. They contain less rubber and are generally of lighter construction. Heft one and see. You may even be able to pull the sidewalls together with one hand, until they touch. Third-liners are lighter still.

What about premium tires? they used to be strictly plush, but this year they have some good safety features that really work. You pay for them. For about $60, one big maker (U. S. Rubber) will sell you a tire with a layer of "steel cloth" bonded between tread and carcass. It really keeps out nails. Another (Goodyear) sells, for about $80, a tire within a tire. You inflate the air chambers separately. The "inner tire," a diaphragm of tough rubberized nylon, takes air through a conventional valve. The outer tire takes it through an all-rubber football valve in the white sidewall. You keep in your glove compartment a small, lubricated, metal needle-valve. Insert the stem of this in the football valve, and now you can attach any gas-station air hose to the valve end.

If such a tire goes flat, the maker says, you can keep right on running on the air in the inner tire until you reach a gas station. Does this hurt the soft outer tire? No, says the maker, since its cords are made of nylon. You can run 100 miles if necessary, Goodyear claims.

Another producer (Firestone) gives you tubeless tires with a different kind of inner-diaphragm protection. In these, air pressure in an outer and inner chamber is equalized through a flutter valve that lets air pass freely into the outer tire during use. (Goodyear's Life Guard tube uses the same principle.) But the valve snaps shut automatically when the outer tire is punctured or blows out, and locks enough air in the inner chamber to permit a safe stop.

Do you want self-sealers? These are tubeless tires that contain a soft-rubber "sealant" that plugs up punctures. The sealant holds heat in your tire, but up to 60 m.p.h. the heat is not great. Above that, some engineers say, you're holding more heat than is good for your tire.

Sealant works well on punctures. But you may have heard that it "puddles" in your tire after you've been running on hot roads, and forms a lump that throws your tire out of balance and causes thumping. This has been true in the past, but this year the makers claim they have licked the problem by (1) using

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6 Money-Saving Hints for '57 Tire Buyers

B. F. GOODRICH

1 Buy your tires in pairs if possible. A new tire matched with an old one on the same axle may wear out faster.

2 Check your guarantee. Some makers now give you protection against all road hazards for 30 months. Others protect you against failure for the life of the tread. One man who had an out-of-round tire that thumped annoyingly took it back, under a guarantee, and got a new tire free. This is unusual. Usually your allowance is "adjusted." As a rule, the adjustment is determined by the amount of tread left on the tires. You get a new tire, but pay for the wear you got from the bad one. If your maker claims a tire should go 24,000 miles and it blows out at 12,000, you normally will get a new tire at about half price.

3 Shop around. "It's a cutthroat game today," one dealer said, "with each of us out-discounting the others." Many dealers will knock off 10 percent at the drop of a hat—but you don't get it if you don't know about it—and ask for it. On a $30 tire, that's a saving of $3. Another $3 allowance for your old tire—which is not unusual—brings your saving to $6.

4 Insist on a trade-in allowance. Many car owners don't. You should get at least $2 if the tire is worth recapping. (Otherwise, it is of no value to the dealer, of course.) If your casing is recappable, your dealer will recap it and get anywhere from $8 to $12 for it. Some dealers allow as much as $3.50 for a good casing.

5 Watch for the three big annual sales: pre-Memorial Day, pre-July 4 and pre-Labor Day. All begin from two weeks to a month in advance. Sample savings: a $30 tire for $25; an $18.95 tire for $15.95; a $15.95 tire for $12.95.

6 But don't overdo the bargaining! Nothing pains your regular garageman so much as putting your car on the lift at his place—and seeing his competitor's tires. After all, your garageman, if he has reason to feel friendly toward you, can save you quite a lot in repair bills over a year's time.

a stiffer sealant, or (2) as Seiberling does, by building small rubber bulkheads to keep the stuff from flowing when hot.

How many plies? Most tires today are four-ply. A few six-ply tires are made, but you need them only for steady use toting around heavy loads—as in a hard-working station wagon.

What kind of treads? Treads this year tend to be "chopped" into many small sections. There are more diagonal edges molded into the tread to (1) stop squeal and (2) prevent side-slipping, especially when cornering. At least two makers (General and Goodyear) offer tires with a center dividing line down the tread.

Some top makers, such as Armstrong, now mold small rubber "buttons" between tread ribs to keep the spaces ("voids") between them from closing up. This prevents skids, and cuts squealing.

Some treads come in irregular tread patterns—to quiet the "road harmonics" or hum that comes from some uniform treads.

You'll see more cross-slitting this year. A few seasons back one maker found that hundreds of small razor slits cut across the tread added to your stopping and starting traction. Now several makes use cross-slits.

Cold-rubber treads are now routine. These are made from the same basic chemicals as the original tire synthetic. It is called cold because the chemical synthesis takes place at much lower temperature, producing a material that is tougher and more abrasion resistant than the so-called "hot" synthetic. END

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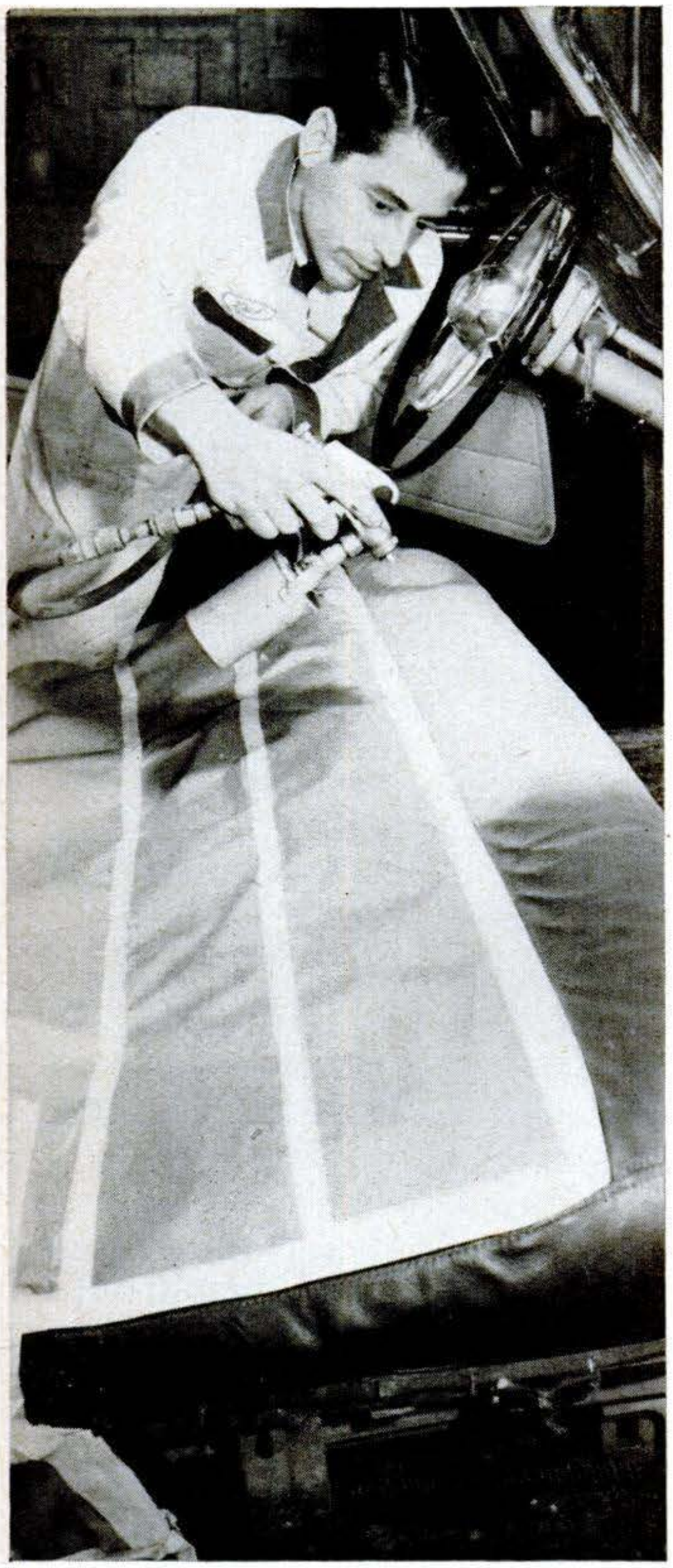
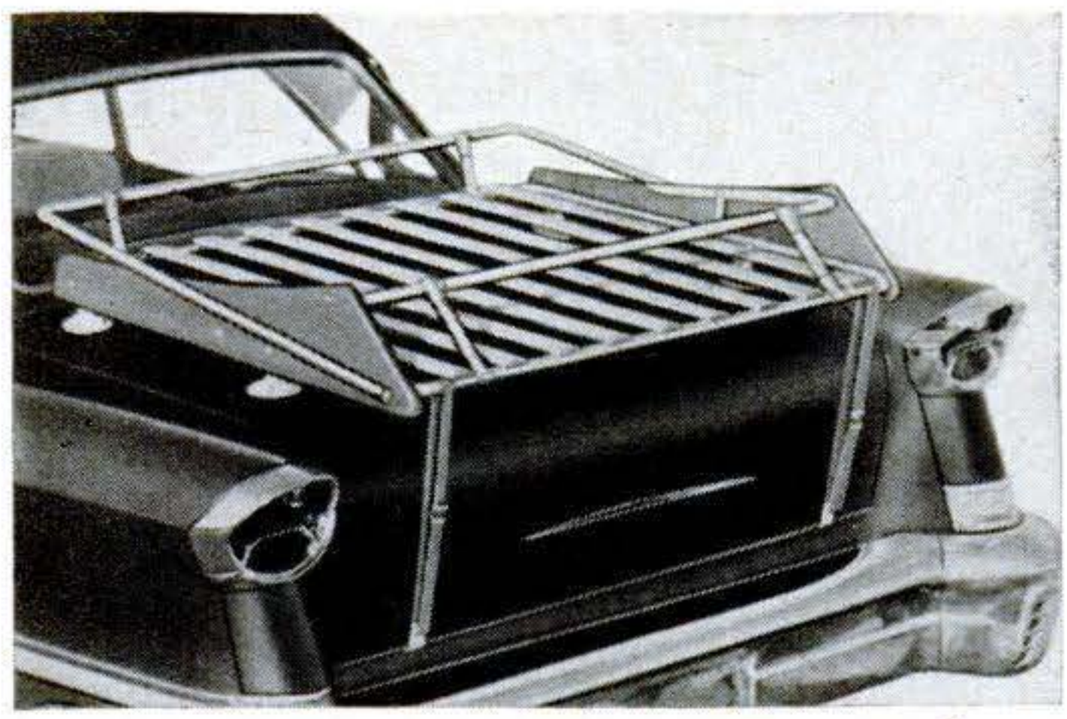
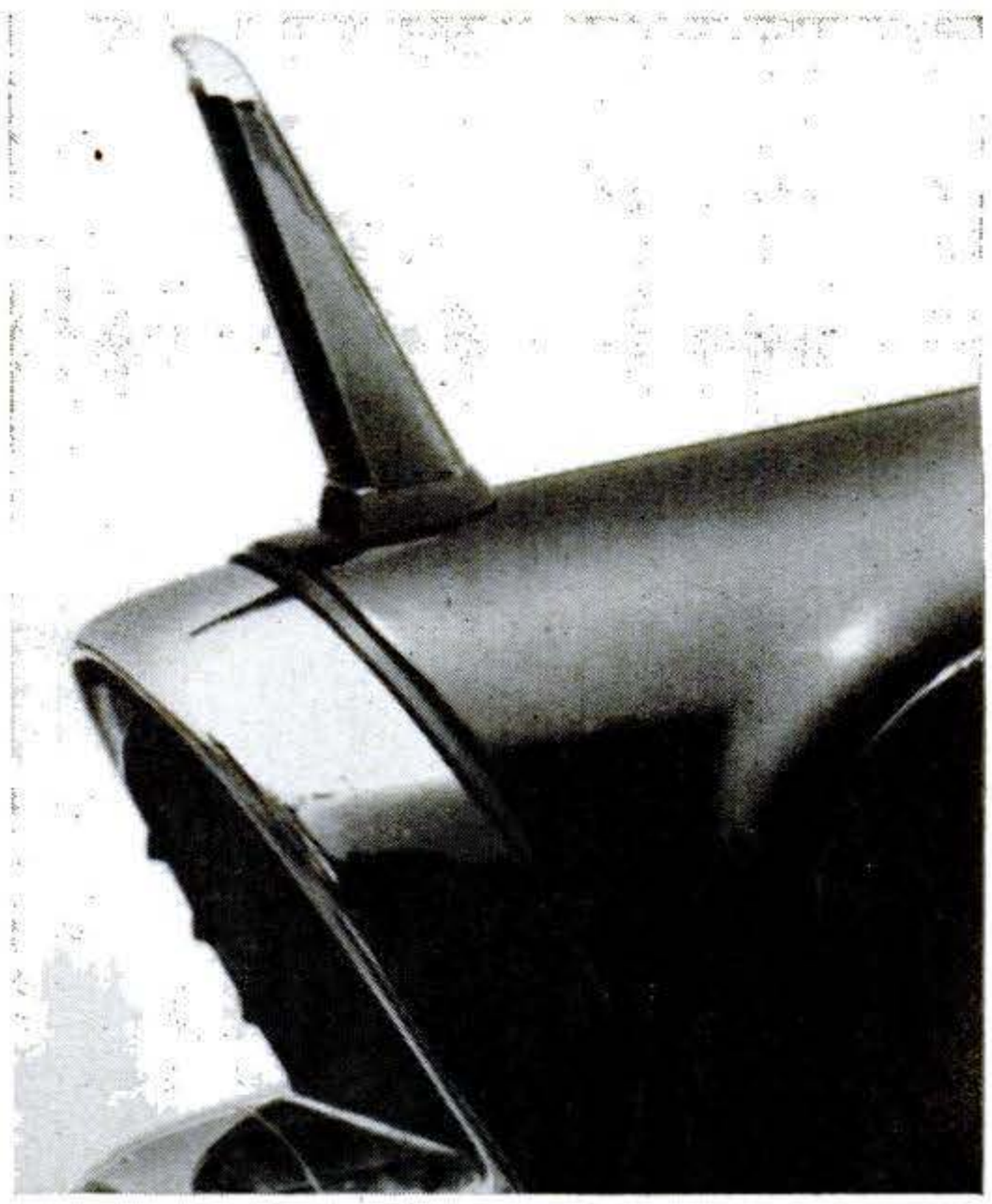
New for Your Car



1. Spray Renews Upholstery. Shabby interiors perk up when refurbished with a new paint spray. It puts a smooth coat on nylon, plastic or leather seats, dries in 15 minutes and is said not to crack, rub off or fade. You need only clean with solvent to prepare the surface, and mask for a two-tone job. On sports models having hinged-back seats, the back is removed for separate spraying.



2. Cargo Carrier Fits on Trunk. Luggage, bulky packages and camping gear are within easy reach if you have one of these carriers on your trunk deck. Permanently mounted, or temporarily fastened with suction cups and straps, it lifts with the trunk lid even when loaded.



3. Stop Lights Ride High. These lights bolt to rear fenders or clamp on a trunk lid so drivers behind can see your signals far ahead. Clips on the hookup wires bite through the insulation on the stop-light wiring to turn on fin lights when you brake or signal a turn.

More information *about the products shown on this page can be obtained from: 1. Local Chevrolet dealers; 2. A. J. Industries Corp., 540 S. Second St., Delavan, Wis.; 3. Sinko Mfg. & Tool Co., 3135 W. Grand Ave., Chicago 22.*

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Which Type of Driveway for You?

Materials and costs can be confusing. Here are facts to help you make a good choice.

By Edward D. Fales Jr.

YOU have a choice of three types of driveways—concrete, blacktop and gravel. Which type you choose depends on the appearance you want, how much you wish to spend, how much work you plan to do yourself, and how much maintenance you want to escape.

Early summer is a good time to start a driveway because the ground is soft for digging. You can then go on to complete your driveway in a day or two if you employ a contractor, or in two or three months if you put it down in 2″ stages, using your own car to roll it.

How much will it cost? Concrete is the mink coat of driveways—it costs the most. Blacktop ranges from medium to costly. A gravel-type driveway is the cheapest.

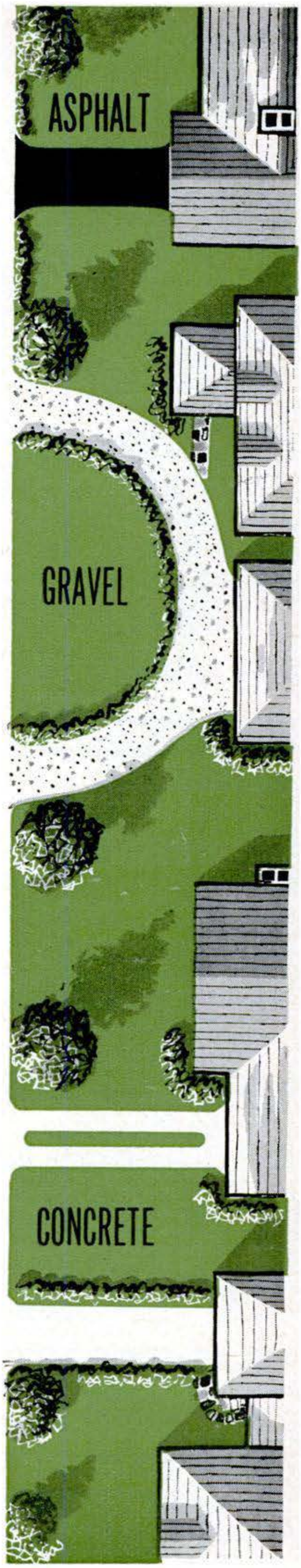
The chart on the next page shows some typical prices for each type, based on actual contractors' charges in various parts of the country. All costs vary considerably, however, depending on where you live and how much material you buy. Prices are lower if:

- Your driveway is over 60′ long.
- You buy materials in big 10- or 15-yard trucks.
- You choose materials from nearby suppliers.
- You and your neighbors have several driveways done at the same time.

A good base is a must. If your base is flimsy, bumpy or soggy, your driveway will never be right, no matter what you put on top.

Inexpensive aggregates such as bank-run gravel and rock screenings make good bases if they're put in deep enough—usually 6″ to 8″ or more. Where water is a problem, however, their fine texture may not provide as good drainage as coarse, porous aggregates.

The best bet is a "constructed" base consisting of two layers of different-sized crushed rock. Many builders



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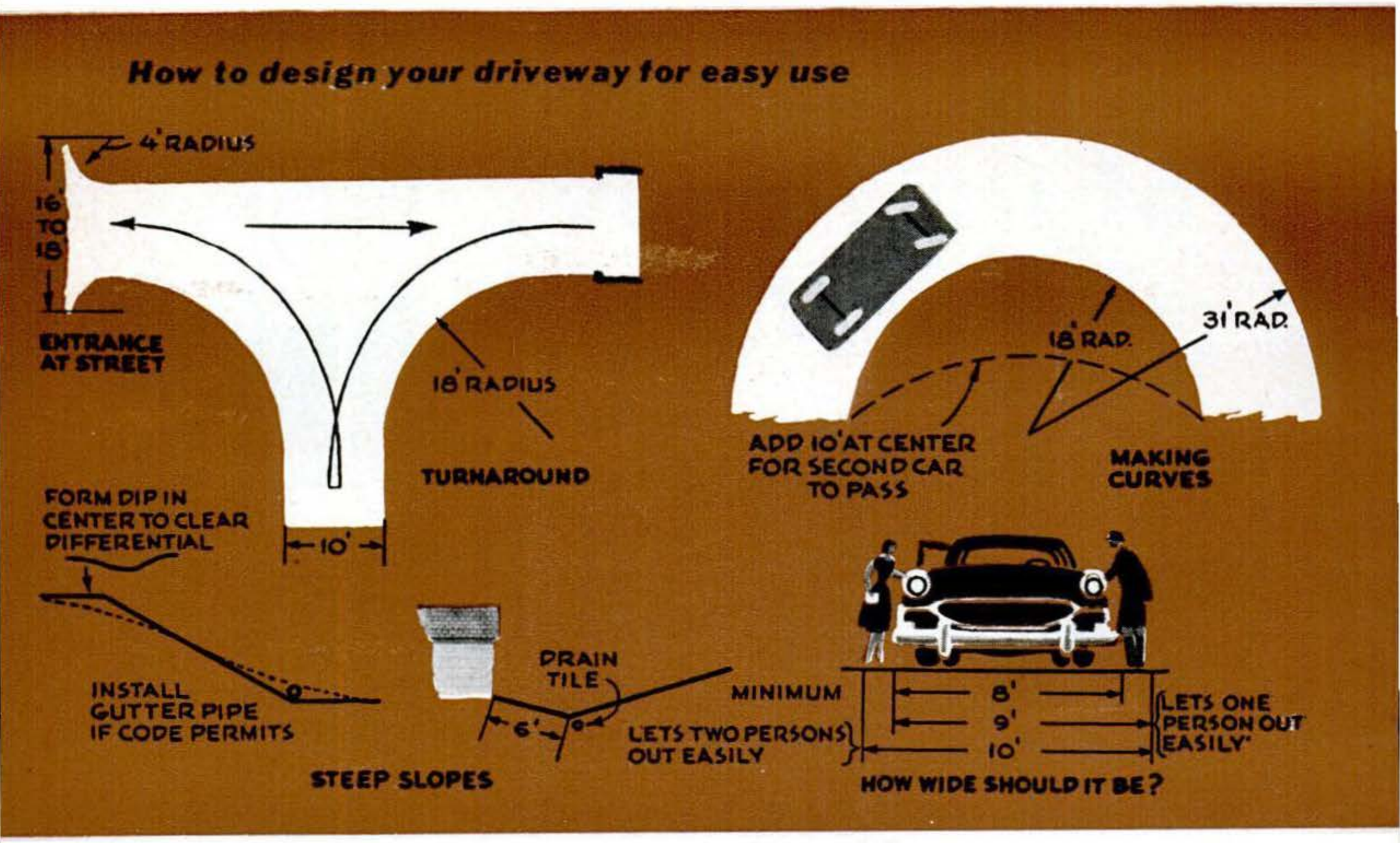
How to design your driveway for easy use



WHAT DRIVEWAYS COST

TYPE OF DRIVEWAY	Approx. cost in cents per square foot when— You have a pro do all work	You buy materials and do job
BLACKTOP		
2" hot mix on 4" base	32-55	(not recommended)
2" hot mix (cost of base not included)	18-25	(not recommended)
1½" cold mix on 4" base	23-41	8-24
1½" cold mix (cost of base not included)	10-20	6-14
Surface treatment on 4" base	8-18	5-12
Surface treatment (cost of base not included)	7-8	3-4
CONCRETE		
6" surface on 6" base	60-$1	20-40
6" surface only	45-75	16-30
AGGREGATES*		
6" crushed stone	6-18	4-12
6" crushed gravel	6-18	4-12
6" washed gravel	5-14	3-9
6" bank-run gravel	3-6	2-3
6" cinders	10-15	8-10
6" slag	2-8	1-5
6" screenings	8-13	6-9

*For 4" thickness, figure ⅔ cost; for 2" thickness, ⅓ cost.

HOW TO ESTIMATE HOW MUCH YOU NEED

Blacktop: One ton asphalt mix covers 85 to 105 sq. ft. One gallon liquid asphalt covers about 18 sq. ft., ¼" thick (with 30-50 lb. of stone chips rolled in).

Concrete: One cu. yd. covers 54 sq. ft., 6" thick. Add 4¢ per sq. ft. if reinforcing mesh is used.

Aggregates: One cu. yd. covers 54 sq. ft., 6" thick; one ton covers about 43 sq. ft., 6" thick (1 cu. yd. equals 1¼-1⅓ tons). Allow up to 25% more for compaction depending on how much local aggregates compress.

recommend that you put down one layer at a time because this gives the material time to pack more tightly.

A good standard depth for all types of driveway surfaces is 4", though in very cold northern climates 6" to 8" is recommended. If oil, coal or other heavy trucks must use your driveway, add 2" more to the base.

Here are six rules that experts recommend for making a good base:

- Start with clean material. For best drainage, the bottom 2" layer of any base should be made with clean, *washed* aggregate. Dirty aggregate, containing sand or clay, soaks up water that will cause frost heaving in winter. The top 2" layer should be clean aggregate, but can be unwashed.
- Buy "graded" aggregates. A mixture of different-size stones compacts better than an aggregate that's all one size—smaller pieces pack tightly around bigger ones. The bottom layer is made of aggregate graded ¾" to 1½" in diameter. The top layer is smaller stuff, graded from ¾" down to coarse sand.
- Specify sharp-edged stones or gravel. Rounded, river-washed pebbles often slip

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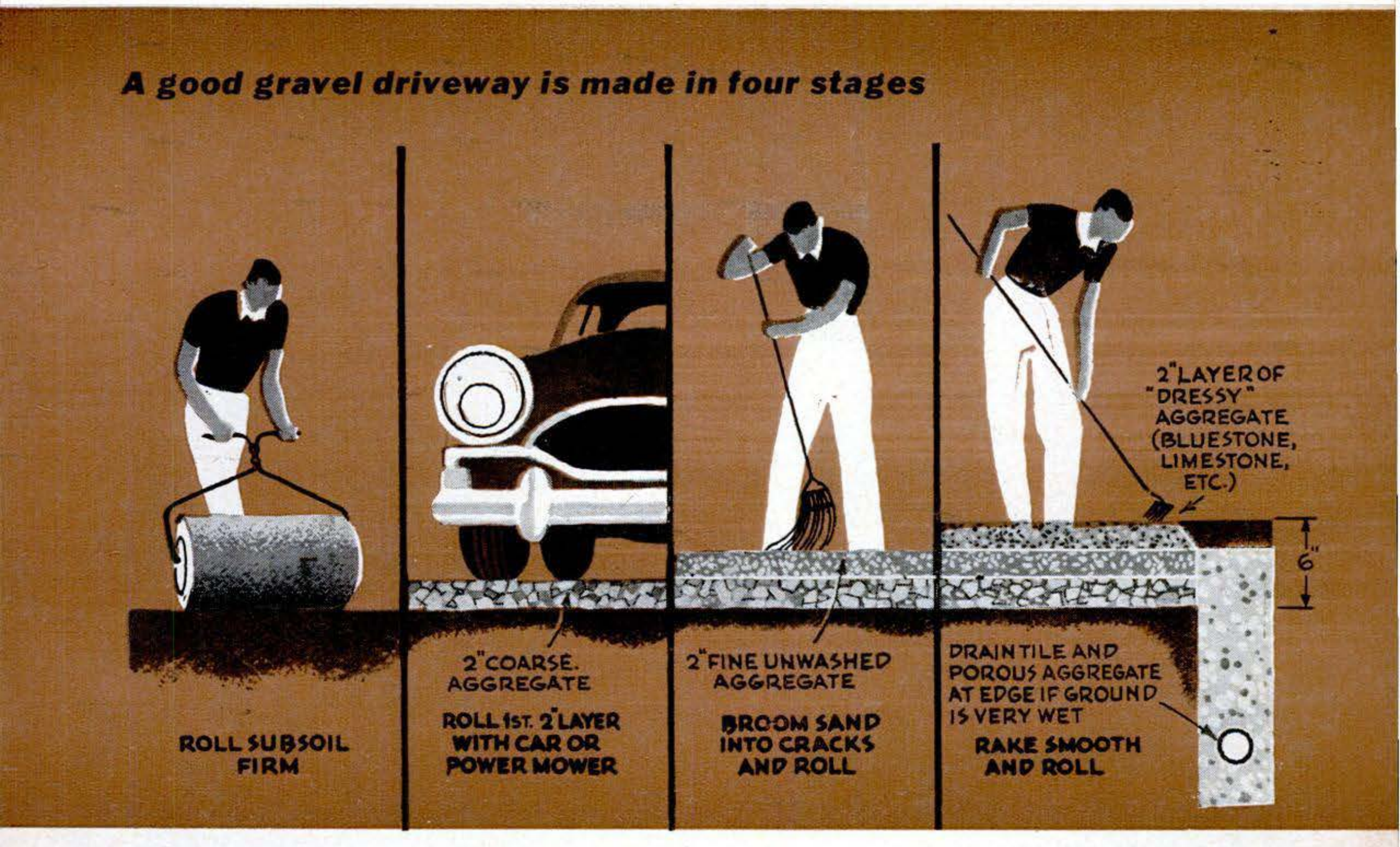

and do not interlock tightly. "Crushed" stones or gravel have sharper edges than naturally formed aggregates and make the best bases.

- Drain the bed well. If there's a soggy spot where your driveway will go, try to drain off the water with a ditch or drain tile, or deflect the source.
- Keep the base even. Never have the aggregate just dumped on your driveway. Make sure it's shoveled in evenly by hand and then raked smooth.
- Roll it heavily. Your car makes a good roller, but the job must be done uniformly to avoid ruts, and repeated periodically for at least eight weeks. Keep the base moist while rolling it.

Gravel-type driveways. These are the easiest to build. They usually consist of a 2″ surface of "dressy" aggregate laid over a less expensive base. They have a smart, yet informal non-highwaylike look.

But they do have disadvantages. Children can't play on them, grass may grow up in them, and snow plows, shovels and feet scatter the loose stones onto the lawn. In time, they wear and rut, and you'll have to freshen the surface with new material every year or two.

The choice of aggregates used for topping can be confusing unless you know how to tell them apart. Here's how the most commonly used types of aggregates compare:

- Crushed stone, such as traprock and limestone, is the neatest looking and most expensive. It comes in sizes from ¼″ to 2″ dia. The smaller sizes are called "chips" and make the best surfaces.
- "Bluestone" is not a type in itself but a variety of traprock or dolomite that has a bluish cast. Other varieties have a reddish tinge and are called "redstone." Limestone is almost pure white. All are handsome.
- Crushed gravel ranges from ¼″ to ½″ diameter, is a good-looking light-to-medium brown, and in some areas is cheaper than crushed rock.
- Washed (uncrushed) gravel also looks good, but has round edges and may not stay in place as well as crushed stone.
- Bank-run gravel is a yellowish, sandy mixture. It has poor appearance, but is very cheap and wears well.
- "Screenings" is a fine, flourlike material left over after crushed stone is

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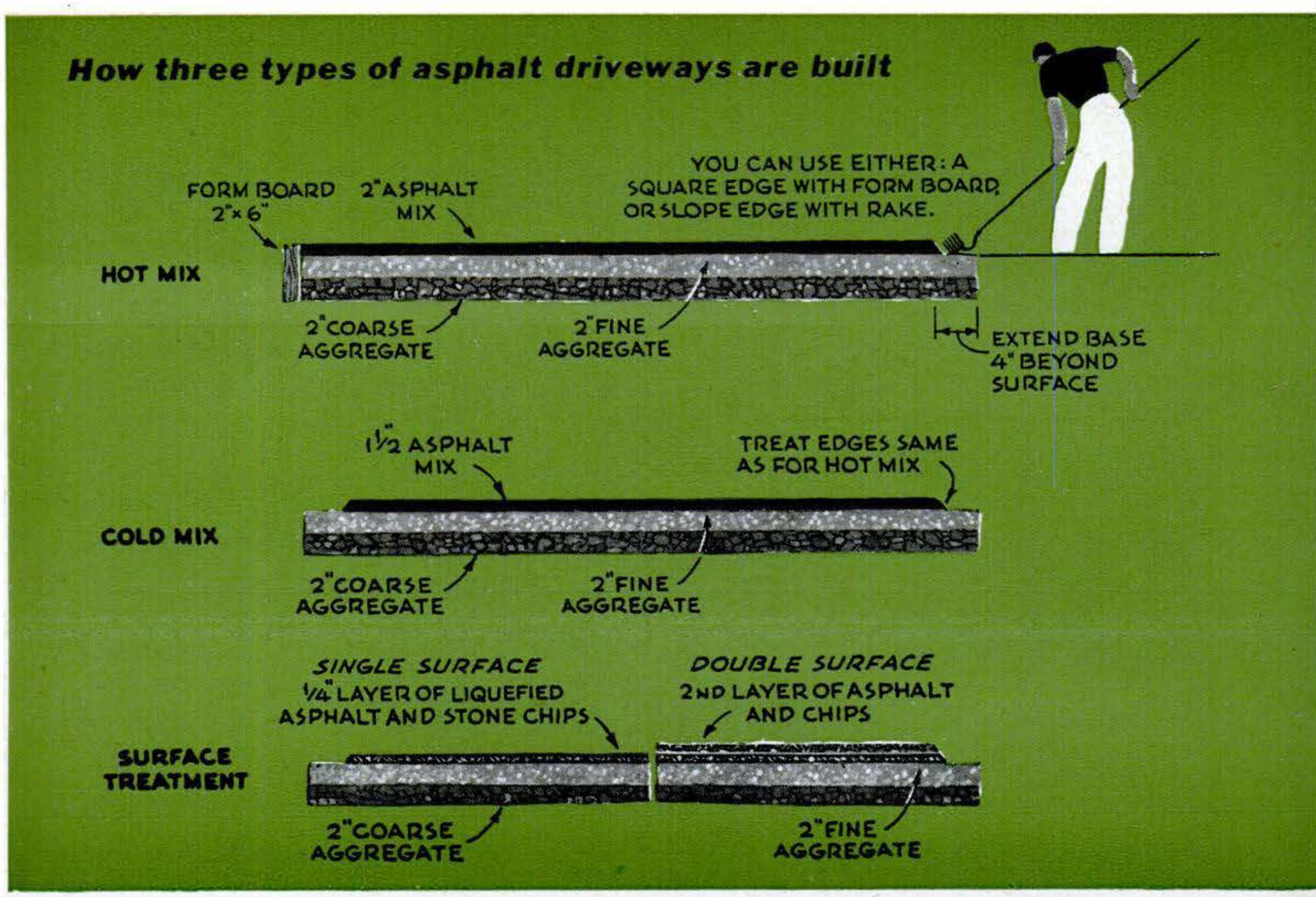

screened. It packs hard, makes a tough-wearing surface, but does not have the appearance of real stone.

- Cinders make a good base but provide a dirty surface that may be tracked into your house.
- Crushed slag, very cheap near industrial centers, makes an excellent, though dark-looking, surface.
- Shale is available in the Midwest and West. Some shales are good, others poor. Consult local builders for the best type.
- Oyster shells and coral rock (crushed coral) are used extensively in the South and make low-cost driveways.

Blacktop. This is the cheapest way to get a real pavement. It usually costs less than half as much as concrete, yet will last 10 to 25 years. Being flexible, it can heave (as much as 2″) without cracking. If it does crack, it can be repaired with unnoticeable patches. Old surfaces can be rejuvenated inexpensively with a quick "shot" of liquid asphalt.

Being black, asphalt also absorbs heat. If you shovel a few patches clear of snow on a sunny day, the rest of the snow tends to melt.

Blacktop is not just one material—it's a general term for several types of asphalt and tar surfaces:

- Hot-asphalt mix is the most expensive and most durable. It consists of semi-solid asphalt that's melted and mixed with aggregate at 250°F. to 350°F. and delivered to you hot. It's raked level about 2″ deep, then power-rolled. It sets up almost immediately, can be used in a few hours and forms an extremely smooth, hard surface that makes an excellent play area for children.
- Cold-mix asphalt is aggregate plus liquefied asphalt (in solvent) or emulsified asphalt (in water-base emulsion). This is mixed at about 125°F. and delivered to you at air temperature.

Cold mix provides a slightly more granular surface than hot mix. It's put on a little thinner, is a little cheaper and is a little less durable. In some areas where you haven't a choice, either one will make a good pavement.

Cold mix does have the disadvantage

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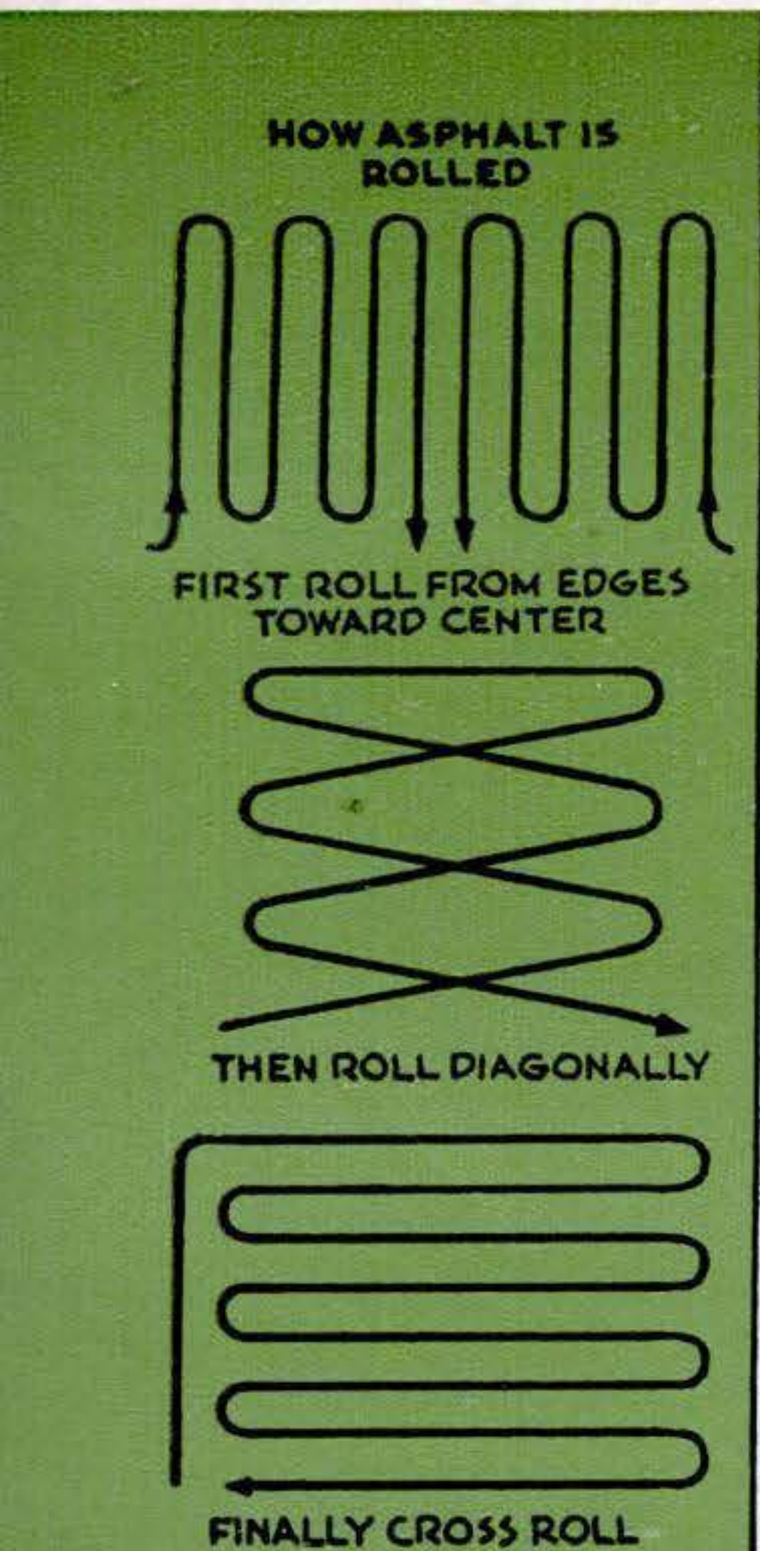

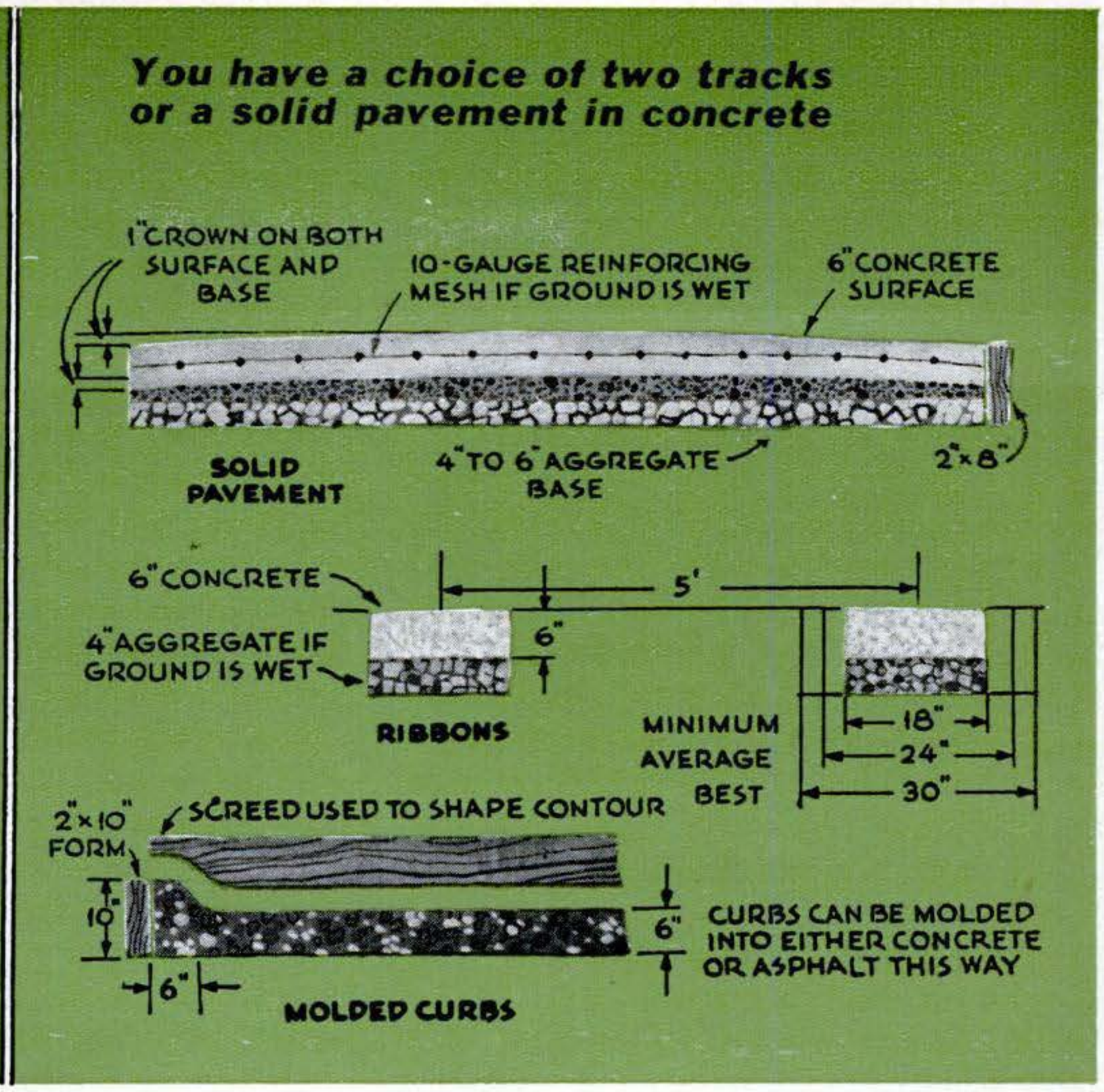

of setting up more slowly. You can't drive on it for a day or two, and it actually continues to harden for a full year. During that time, your car won't hurt it, but ladder legs, high heels and other sharp objects will dig in.

Cold-mix asphalt is easier to repair, however, because patches bond better to its granular surface than to the smoother surface of hot mix. Also, hot mix should be patched with hot-mix asphalt, which is often hard to get in small amounts.

• "Surface treatment" is the cheapest asphalt paving—and the least durable. A thin layer of liquefied (or emulsified) asphalt is sprayed over a base, then a layer of stone "chips" is rolled in.

This "single surface" treatment is often called a "once-a-year" driveway because it must be renewed periodically. In "double surface" treatment, a second layer of both asphalt and chips is laid over the first, providing a more durable surface that will last several years.

• Packaged asphalts sell in handy amounts in liquefied form and in several dry-mix types. The liquid is for surface treatments, while the dry mixes are spread and rolled much like cold-mix asphalt. Good for patching and small areas, these are sometimes used for an entire driveway.

• "Oiling" is not a true asphalt pavement, but is very cheap as a dust-laying operation and will last several months.

• Tar is used in fewer driveways today because it is less plentiful than asphalt. Where available, it makes a good surface and, if damaged, is more self-healing than asphalt. On the other hand, asphalt tends to weather better. Tar and asphalt cost about the same.

If you want curbs, they can be molded right into either a blacktop or concrete surface, or you can add many types of other curbs.*

Concrete. This is one of the most durable pavements you can put down—it lasts 20 to 30 years. It looks smart,

• •

****NEXT MONTH***

Curbs for your driveways: Five ways to add inexpensive and decorative edgings to any type of driveway.

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has a light-reflecting surface that's easy to see at night, and makes a fine play area. You can have almost any color you want built right into the mix.

But concrete is expensive—from 40 percent up to three times more than asphalt. It also tends to "ice up" in cold weather more than asphalt, and is more difficult to repair. Once badly worn, it *cannot* be resurfaced with concrete—the best repair is a topping of asphalt.

It's a good idea to get competitive bids before you decide whether concrete is for you. And specify the mix you want: 1 part of cement to 2½ parts of sand and 3½ parts of aggregate (preferably gravel or crushed stone), as recommended by the Portland Cement Association. In northern climates, also specify "air-entrained" concrete. This reduces scaling and damage from salt used to melt ice.

Some concrete driveways are poured directly on well-compacted soil, but a base is recommended if the ground is wet and subject to frost or if heavy trucks use the drive. Wire reinforcing mesh is also desirable where frost is heavy.

How much can you do yourself? You can save substantially by doing some of the work yourself if you know which jobs are the easiest and most practical.

You can save from 25 to 40 percent of the cost by putting down your own base. You can also add your own aggregate topping for a gravel-type drive.

Concrete is not difficult to handle if you use the ready-mixed type. But you'll need at least two helpers with wheelbarrows to spread it, and you'll have to work fast. After a short time, delivery trucks add a "waiting charge" of $10 or so an hour.

Mixing your own concrete is not recommended unless you can't handle a large amount all at once. By the time you buy the materials at retail prices and rent a mixer ($5 to $10 a day), the cost of mix-it-yourself concrete nearly equals that of ready-mixed.

The Asphalt Institute does not recommend hot mix for self-installation at all because of the danger of burns from the high temperature. But you can put down cold mix yourself. Be sure to have the base ready so that the truck can help spread the mix for you. You'll need to hire a five- to 10-ton power roller ($15 to $30) to compact it.

You can pour on your own liquid asphalt for a surface treatment, then roll in the stone chips with your car. But wait about three hours to avoid ruts.

Designing your driveway. The danger of accident from backing blind into the street can be eliminated if there's space for a turnaround. If there isn't, be sure that the entrance is clear of trees, shrubs, fences and other obstructions that obscure vision.

How wide should it be? Most driveways are 9′ but 10′ to 11′ will save your lawn. Minimum is 8′.

Do you want "ribbons"? Two tracks save roughly a third of your materials cost. But grass in between is often killed by oil; the tracks are hard to stay on, especially on curves. Trend today is to solid pavement.

Curves must be 3′ wider than straightaways—your front and rear wheels track differently. Curves that bend to the *right* are hard to see from the left-front driver's position—especially in backing. Where you do much backing, try to make curves bend to the *left*.

After you've staked out your drive, make a few dry runs in your car to see if it really works.

Steep slopes are best paved—gravel will wash away. To increase traction, concrete is sometimes scored with cross lines. In asphalt, a coarse-textured surface provides a good grip.

Some driveways slope as much as 30°, but it's better to hold the angle to no more than 20° if you can. END

This reference sheet may help you next time you're called upon to do something about a toilet that won't shut off. It's one of a series of monthly home-repair guides you can save.

Next Month: Venetian blinds.

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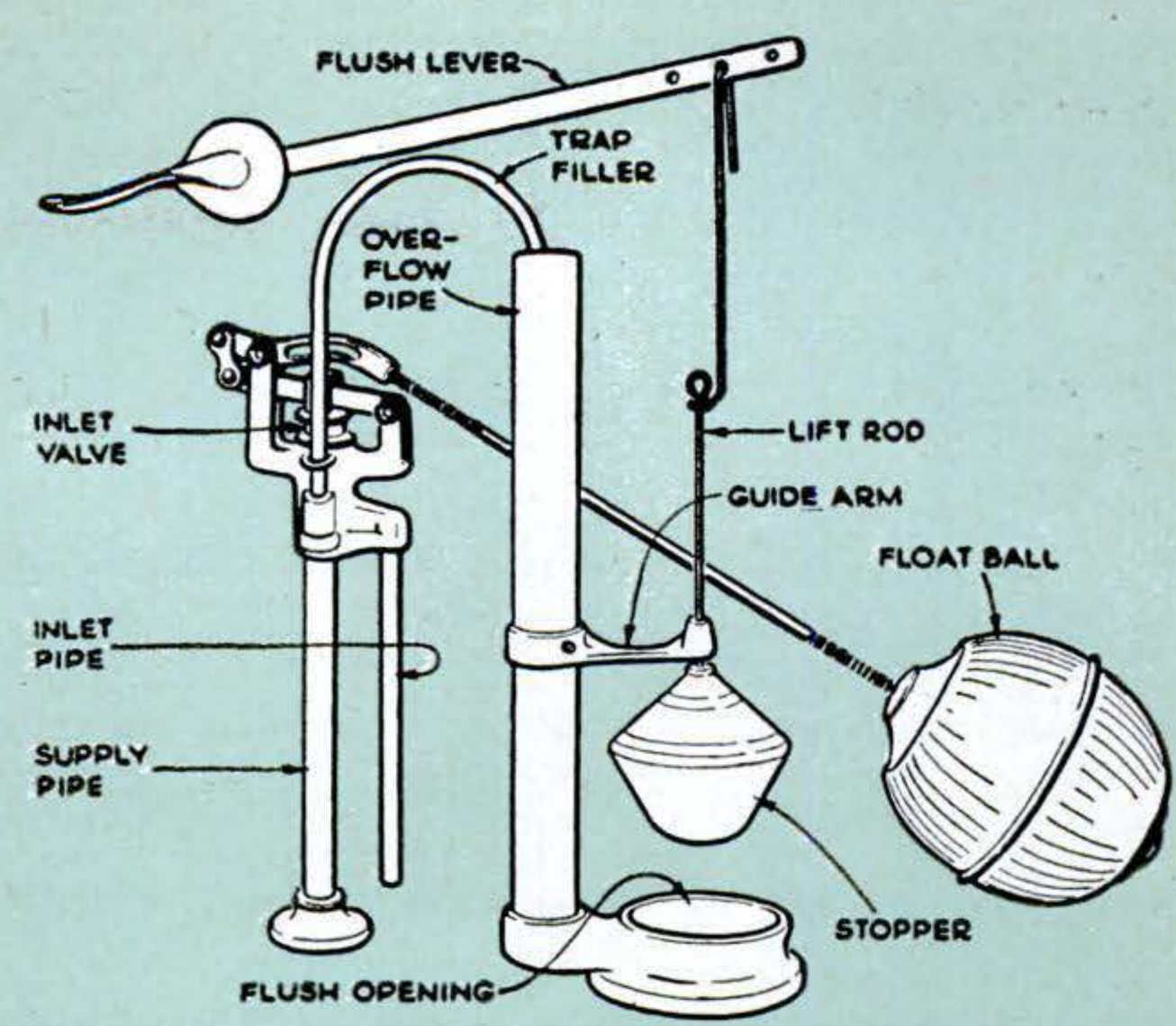
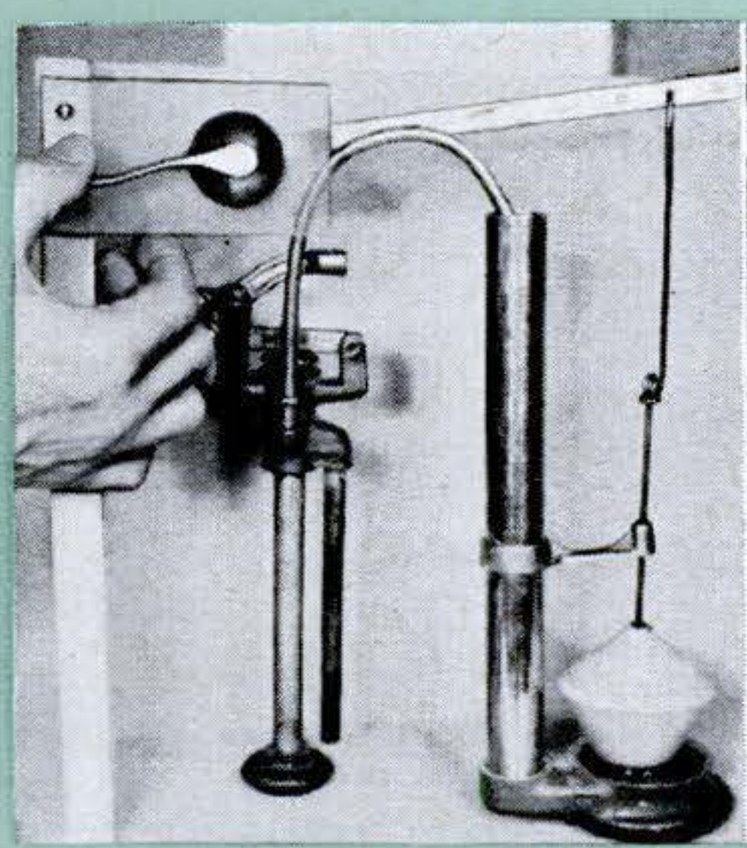
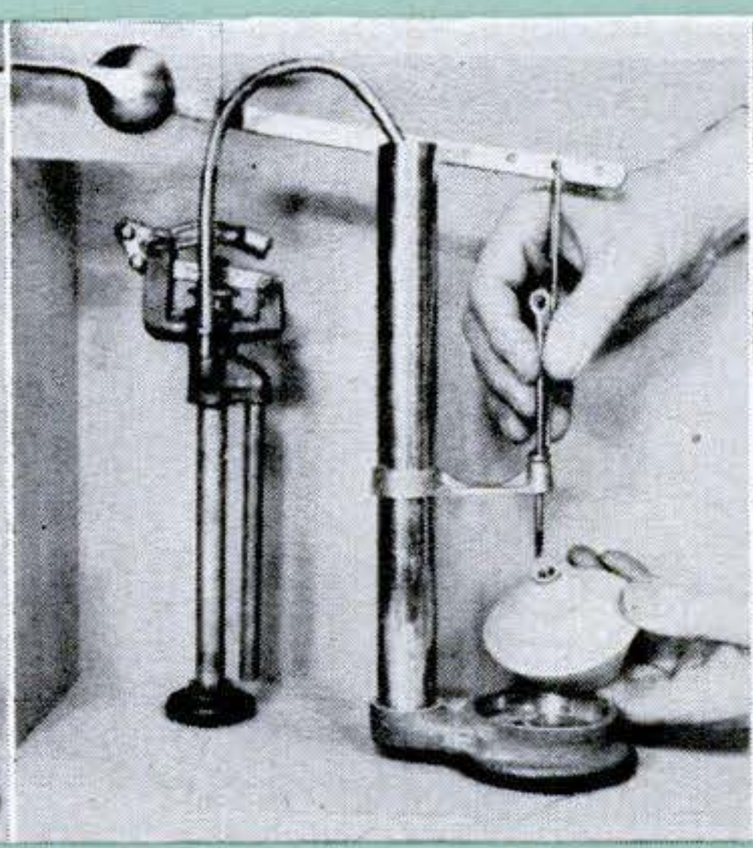
The Parts and What They Do

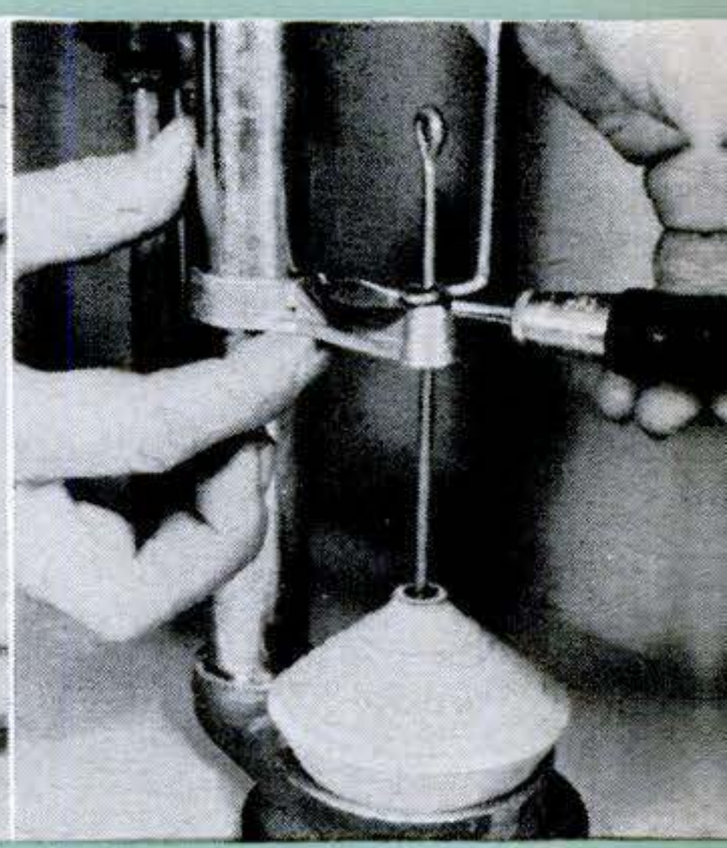
TWO VALVE SYSTEMS are found in any tank. The flush valve lets water into bowl when you work the handle. As the float drops, inlet valve opens and inlet pipe directs water to tank bottom to prevent splashing; the trap filler shoots a stream through overflow into bowl to seal trap against sewer gas until tank fills. Rising float shuts off inlet valve. If inlet or float are defective, overflow keeps tank from running over.



Trouble in the flush valve may be caused by:



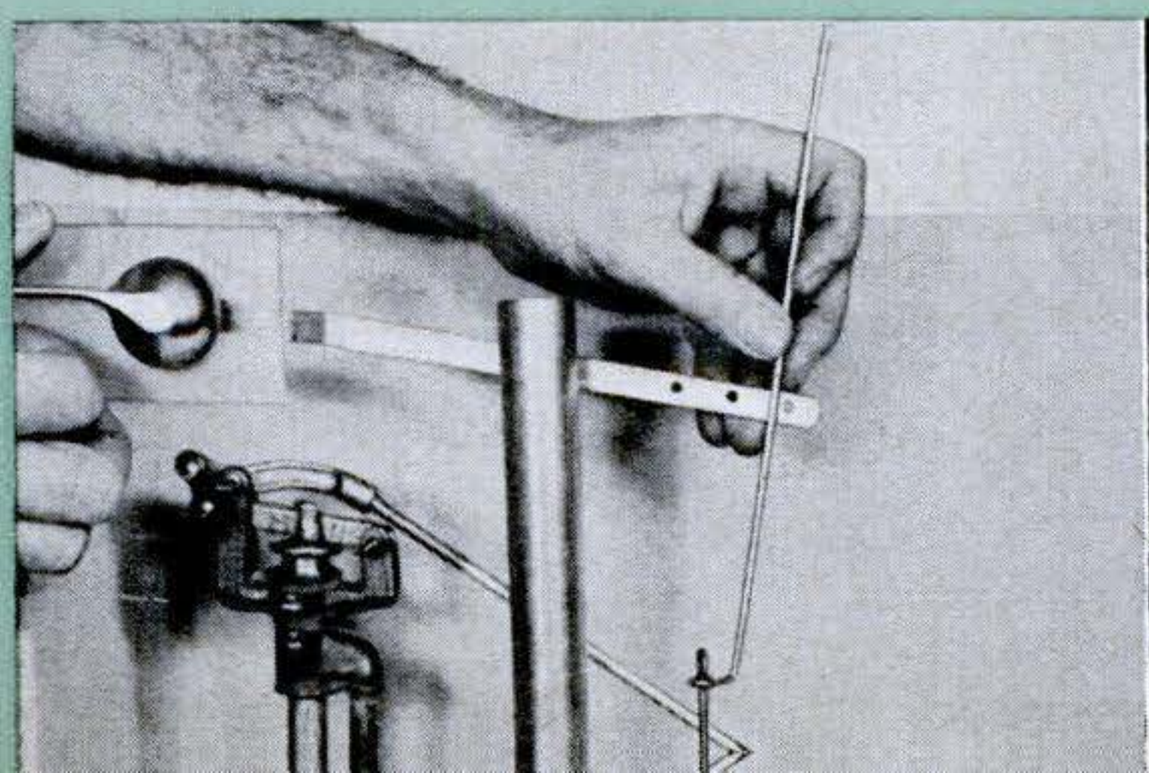


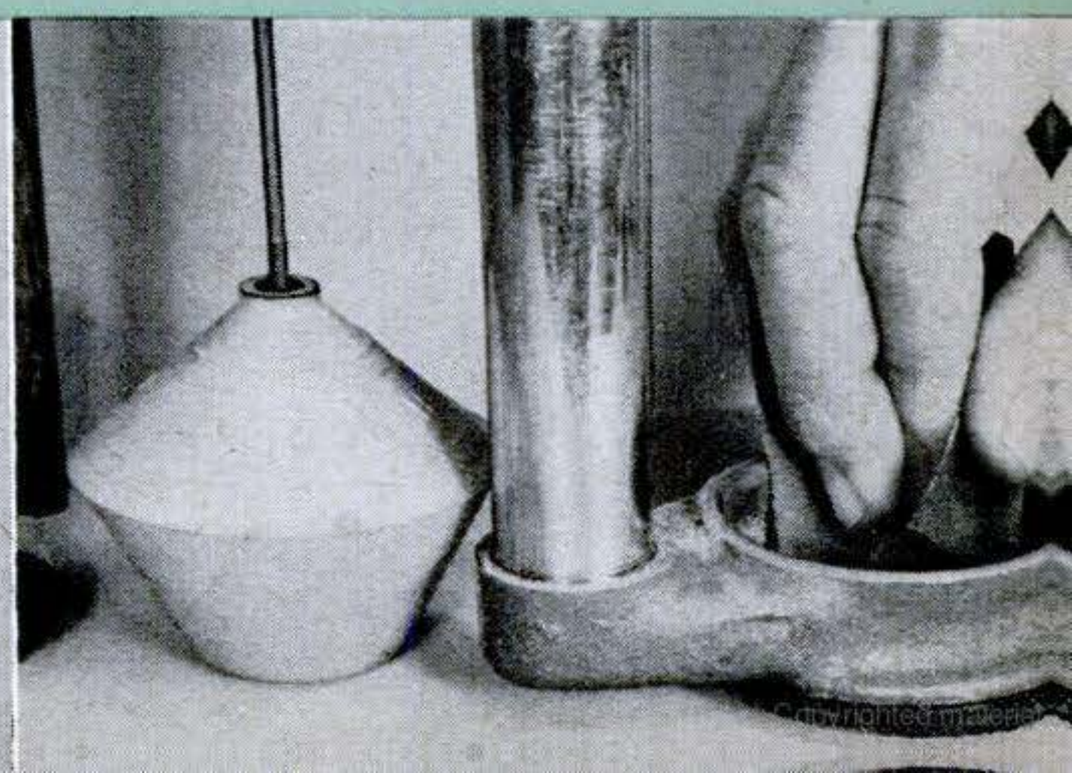


1. A DEFECTIVE STOPPER. This is the most frequent cause of a leaky valve. In time the rubber deteriorates and the stopper ball becomes spongy or out-of-round. To replace it, unscrew the old stopper from its lift rod (center photo) and turn a new one on. Guide arm (right) should be centered over valve opening. If it isn't, loosen setscrew and align it. Flush toilet several times to see that the stopper drops onto the seat.

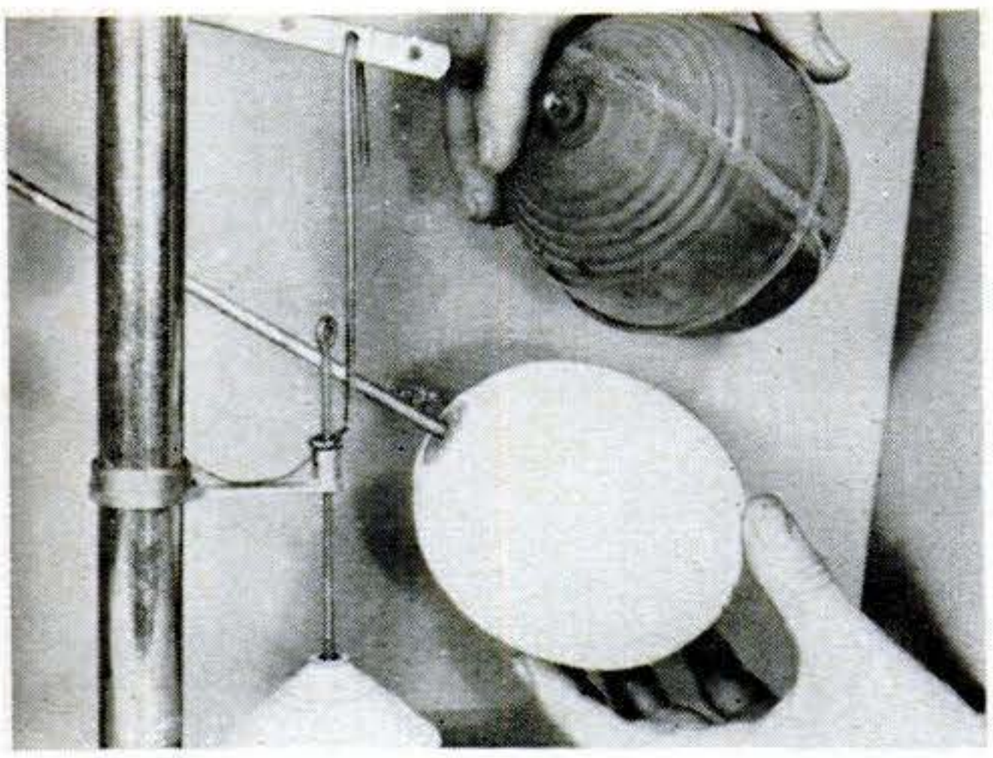
2. BENT LIFT ROD OR CONNECTING WIRE. Either one restricts stopper action; both can be replaced for 10 cents. Screw new rod into stopper, then measure length of new wire with lever arm in down position. Bend a hook in the end to fit the arm loosely.

3. ROUGH VALVE SEAT. Dirt on the seat or pits in metal may prevent a good seal and let water seep into bowl. First, clean the seat well with a soapy cloth; then rub with a piece of emery cloth to remove any built-up scale and make the surface smooth again.

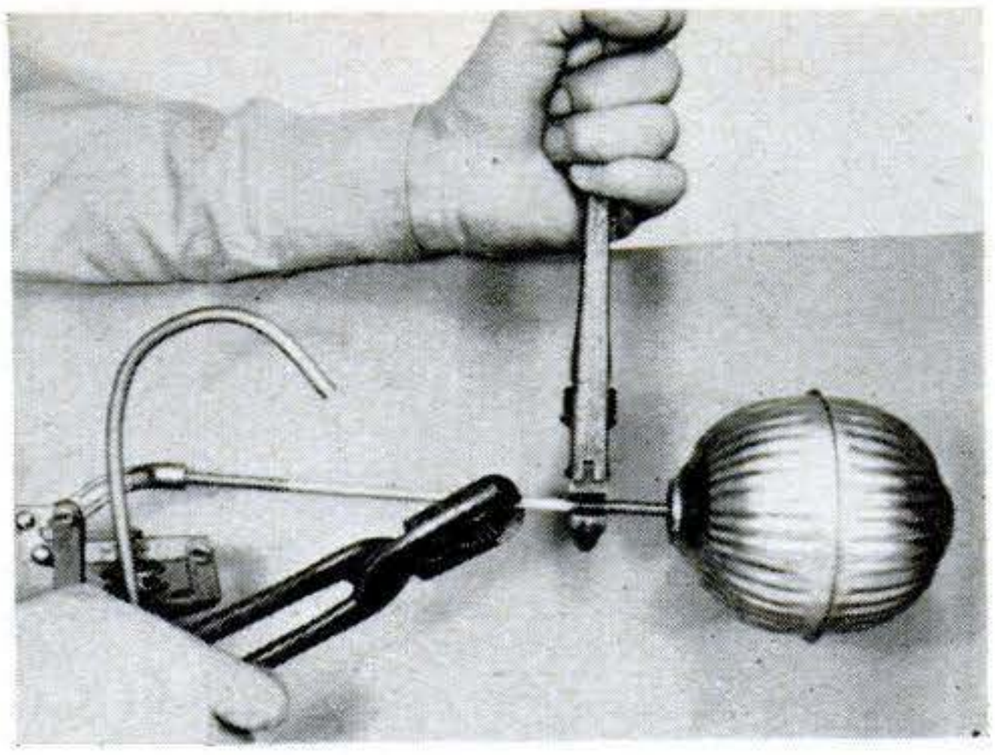




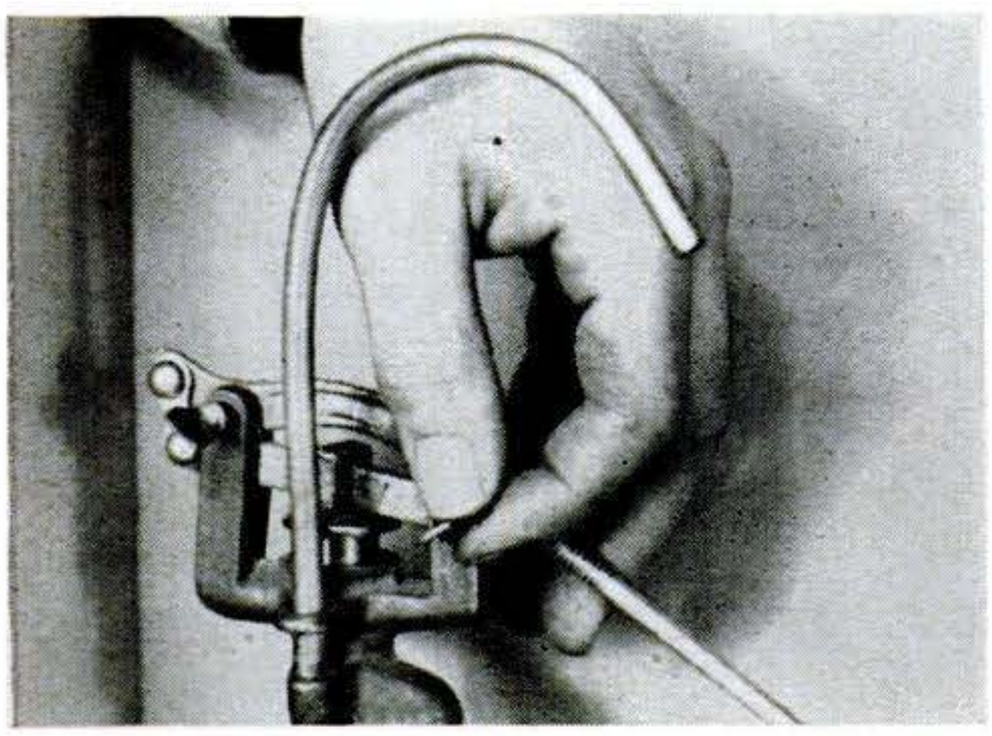
Trouble in the inlet-valve system may be caused by:

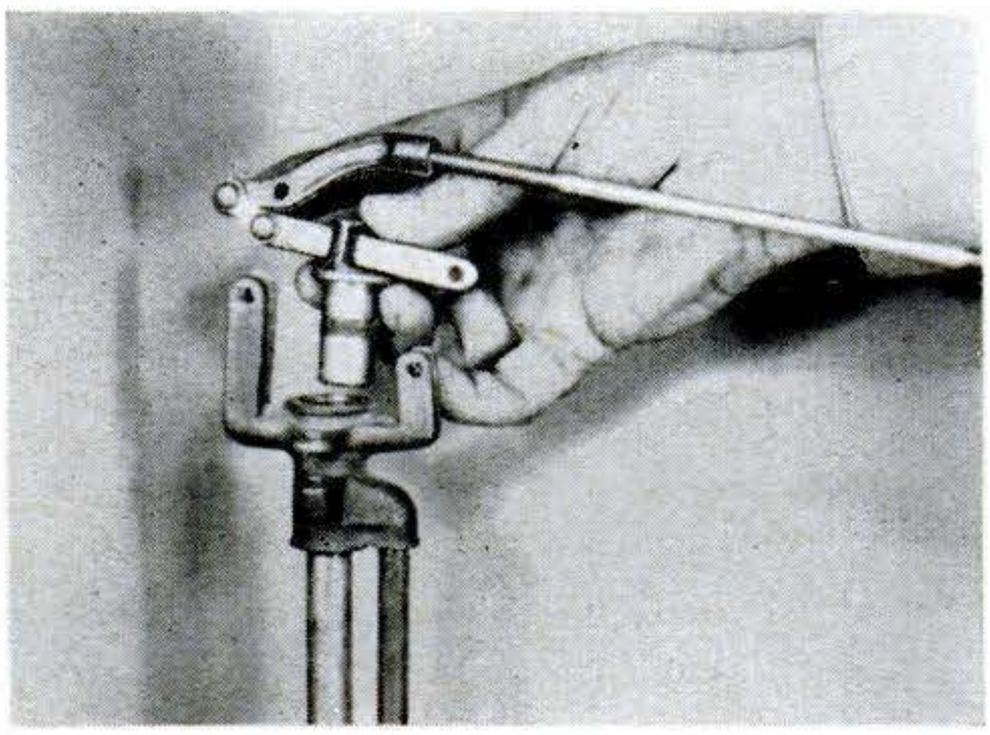


1. A LEAKING FLOAT BALL. Pinholes in a copper float sometimes admit water, keeping the ball partly submerged so that it doesn't fully close the inlet valve. The remedy—a new float—costs less than 50 cents. Screw it on the float arm in place of old one.

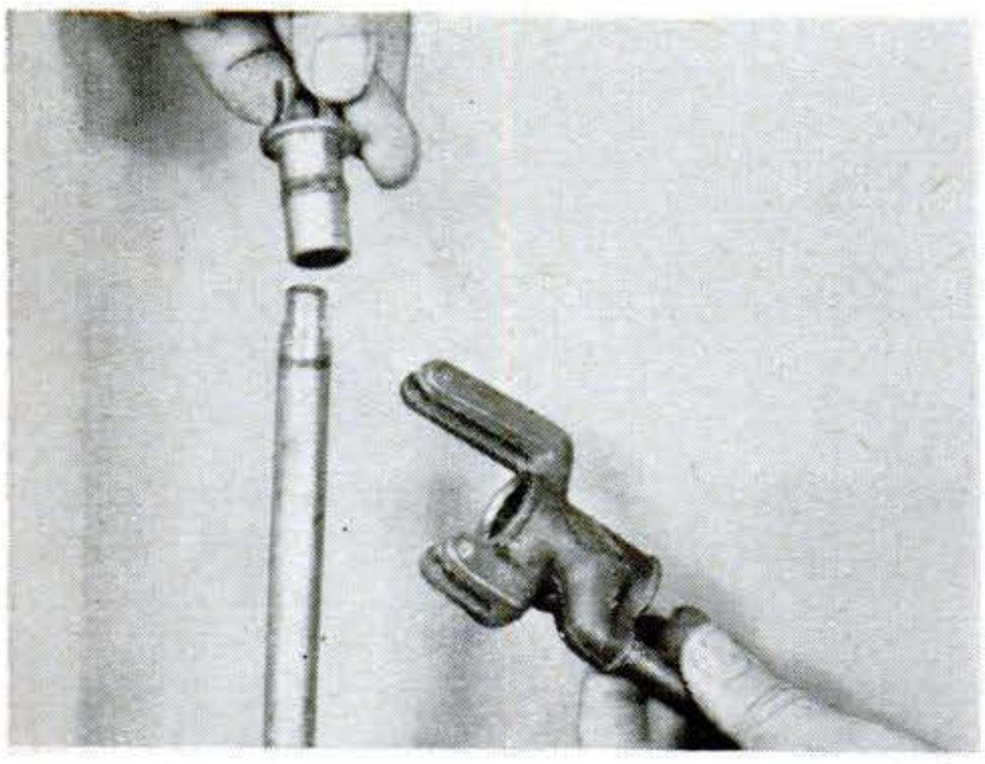


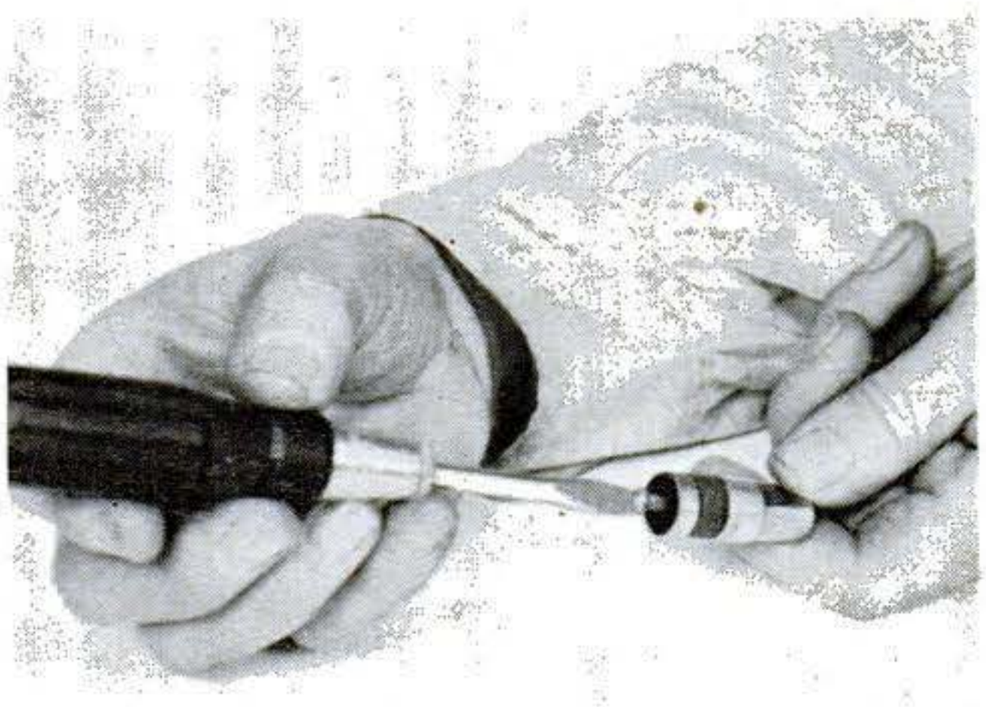
2. BAD FLOAT ADJUSTMENT. If the water rises too high in the tank and runs out the overflow pipe, bend arm downward until the float closes the inlet valve at a level high enough to flush the bowl adequately, no more. Too high a level just wastes water.





3. WEAR IN VALVE ITSELF. When float pressure fails to shut the inlet valve, the washer may be worn, its seat pitted, or the plunger jammed by rust or scale. To change washers turn out the thumbscrews that hold the plunger lever and lift the plunger out of the cylinder (above) along with the lever assembly. Inspect leather shutoff pad on plunger's end and leather ring in groove around its middle. Check linkage holes for out-of-round wear. Look into valve to inspect the seat for scale or roughness.





VALVE REPAIRS THAT YOU CAN MAKE. If the inlet-valve seat is rough, it can be reached for smoothing with fine emery cloth by unscrewing the valve body. If smoothing doesn't help and the leather ring or pad on the end of the plunger is worn, unscrew the entire assembly from the flange at the bottom of the tank and replace it. This costs about $3. Some plungers have leather end washers that can be changed like faucet washers (as in the photo above). On this type, a center washer is used instead of a ring.

Popular Science Fix-It File

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Boys being boys, they took off, but not before Capt. Jones saw who they were.

Baseball players, family quarrels and tough cons get in the act as a repairman tells—

Why TV Tuners Get Temperamental

By Art Margolis

TELEVISION tuners are as temperamental as people. Take it from an old repairman like me, they're one of the trickiest parts of a TV set.

They're delicate. If you think of the set as a big clankety-clank alarm clock, the tuner is a tiny precision wrist watch. It takes the signal that comes from your antenna and puts it through half a dozen operations before it even reaches the rest of the set. It's also the only thing in a set that has major moving parts. That means mechanical troubles as well as electronic ones.

Tuners are so sensitive that a slight rise in temperature can ruin your viewing. They can wreck the audio as well as the video, start a snowstorm in July, cause flickering, make your picture drift away, and break down in a multitude of other ways. One tuner even got me mixed up with some baseball players—and the police.

The Set That Solved a Crime

FOUR teen-age baseball players were having batting practice out front in the street. It was going quietly until one of the boys, a towhead with a perpetual

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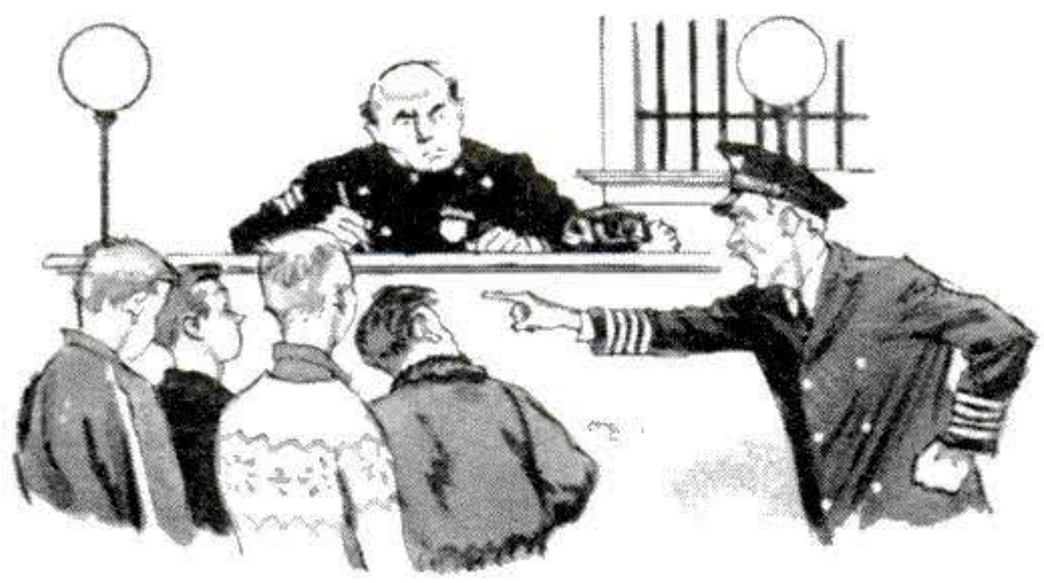
grin, couldn't resist and swung one hard. The ball sailed out toward where the left-field bleechers should have been, then crash-landed through a picture window in a nearby house.

Boys being boys, they took off, but not before the owner, Capt. Jones, a gruff retired ship captain, had seen who they were. He called the police.

That evening I was returning home from my shop through a rainstorm when I heard the fire siren wail. Smoke was pouring from the roof of Capt. Jones' house. Fortunately the fire was quickly put out without too much damage. But when the captain returned home it didn't take him long to put two and two to-



gether. He had the boys arrested for arson.

I figured I was going to stay out of the trouble until Capt. Jones called me for service. His TV antenna had been badly damaged in the fire. I installed a rabbit-ear job in its place. The set came on, but I couldn't get any picture or sound, only light on the screen. First-aid tube measures didn't help either, so I pulled the set into my shop.

I finally traced the trouble to the tuner and started to take it apart. Out of the thousands of transmitters sending out waves, your TV set must select only the few that you want. Your antenna starts the job by picking out the range of frequencies that includes the TV stations. These frequencies constantly induce little electric currents in the antenna that are fed to the tuner. The tuner must then pick out each individual frequency as you want it, excluding all the others.

In Capt. Jones' set, the tuner was a turret type. A rotating drum contains a series of coils that each tune to a different frequency, depending on the number of turns of wire wound around a core. For channel 2 many turns are needed, for channel 13 only a few. There are two coils for each channel, one called the RF (radio frequency) coil and the other the oscillator coil. As you flip the channel selector, you move each pair of coils into position with a set of master contacts outside the drum.

As I exposed the contacts on Capt. Jones' tuner, I saw something curious. Suddenly it hit me. I grabbed the phone and asked for my detective friend, Lt. Bill Cavanagh, at police headquarters.

"Bill, I think we'd better get Capt. Jones and those kids over here right away." There was a dubious grunt from the other end, but he agreed to come.

Capt. Jones arrived first, followed by Bill and four of the saddest-faced boys I'd ever seen. I took Bill and Capt. Jones into the back room and showed them the contacts on the tuner. They were blackened and almost burned away. So was the channel 10 coil where the selector had been set.

As I explained what had happened, the scowl on Capt. Jones' face turned slowly into a grin. He called the boys into the back room.

"It—it seems I've been a bit hasty. It's about time we organized a real baseball team and played over on the big field so you fellows can really slug. I'll supply the uniforms and some new equipment."

The boys' eyes brightened. "But I don't get it," said the towheaded kid. "We didn't burn your house, but how did you find out who did?"

"Nobody did," I said. "Lightning struck Capt. Jones' antenna during that storm we had. It set fire to the roof and traveled down the lead-in and burned out the TV tuner at the same time. That's why these contacts are burned."

Four big grins headed for the door. Capt. Jones had something for me, too—a job to install a ground rod for his TV antenna and a lightning arrester in the lead-in. Which everybody, but everybody, should have.

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Case of the Quarreling Newlyweds

I WALKED smack into a family argument on my next call. They were a young couple just back from their honeymoon, but they certainly weren't acting like newlyweds.

"Every time I try to tune this blankety-blank set," said the husband, "the picture flickers, washes out, then fills up with snow. Some channels won't even come in at all."

"I don't have that much trouble," put in the wife. "John gets so excited over . . ."

"Hold on," I said. "Let's take a look."

Sure enough, as I twirled the selector, channel after channel showed up with either jagged streaks or snow. Channel 10 remained a stubborn blank.

"They do flicker sometimes," admitted the wife, "but I can always bring them back."

As she reached in and jiggled the knob, channel 10 popped into view.

"There. There, you see?" stammered the husband. "It happens all the time."

"Try that again," I said.

"Well, I've found if you push a little on the knob, sort of sideways, like this . . ."

Another channel came to life. The husband glared. I'm no diplomat, but I put on my best impartial tone of voice. "I think maybe you're both a little wrong and a little right. I'll show you as soon as I get this tuner out."

It was another turret-type tuner, with rows of contacts around the drum that are turned to line up with a set of master contacts in the set. As soon as I felt inside, I knew what the trouble was. A spring under the tuner drum had fallen out of its perch.

"You see," I explained, "this spring is meant to hold the tuner up tight against the contacts in the set. Without it, you weren't getting a good electrical connection between the contacts, and the picture washed out or went blank. These contacts are also covered with dirt, which made the connection worse. When your wife pushed on the knob, she pressed the contacts tighter together, which brought the picture back, but only for a while."

For the first time, the young couple smiled. I replaced the spring, cleaned and lubricated the contacts, and buttoned up the set. The husband reached for his wallet.

"Forget it," I said. "Call it a wedding present. And the next time you have trouble . . ."

"I know," broke in the wife. "We'll let you fight over it instead of us."

The Time I Went to Prison

LIKE any businessman, I'm always interested in new customers. But there's one bit of new business I've been getting recently that I'm not so sure about.

It all started when I did a tuner re-

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pair in the recreation room of a nearby prison. Channels 2 and 6 came in fine, but 7 to 13 were missing. The set was an old model. Instead of having two or three tubes for the different stages in a tuner, it used a single 12AT7 tube.

All tuners have three stages—the RF that receives the radio frequencies from the TV antenna, an oscillator section and a mixer. Each TV station has a different frequency, and there are 150 *million* cycles between channel 2 and channel 13. If a set had to process such a wide variety of frequencies, the necessary parts would skyrocket the cost. So the set is made to receive only one frequency. This means that whatever the RF frequencies are when they enter the tuner, they must all leave the tuner at the same frequency.

This is where the oscillator and mixer sections come in. The job of the oscillator is to manufacture a separate but similar frequency to the RF frequency coming from the antenna. For each individual channel that is tuned in, the oscillator must produce a different frequency.

Both the RF and oscillator frequencies are then fed to the mixer where they combine to produce a third frequency that is the difference between the two. As each RF frequency is tuned in, the oscillator frequency is shifted with it. That way, the RF and oscillator track together. While their frequencies are constantly changing, the difference between the two is always the same. This difference in frequency is the IF, or intermediate frequency, that's fed to the rest of the set. The frequency-changing process is known as superheterodyning.

While I was trouble-shooting the set in the prison, one of the inmates came in. He introduced himself as Jackie and said that he too was an electronics man, but that his specialty was burglar alarms.

"It don't figure," he said. "If you can get channels 2 to 6, why not channels 7 to 13? The set must be working."

"The set's working," I explained, "but the tuner isn't."

Jackie looked puzzled. "How can ya tell? You haven't even looked inside the set yet."

I started to pull the chassis. "This particular set uses resonant circuits for tuning. A resonant circuit is nothing more than a coil and a condenser soldered together. The circuit will handle different frequencies depending on the number of turns on the coil or the value of the condenser.

"In this set, two coils are used, one for the low band, channels 2 to 6, and another for the high band, 7 to 13. But both coils are hitched to the same condenser. By turning the selector knob, you vary its value and pick out the channel you want from either band."

Jackie suddenly brightened. "I get it. Since some of the channels are working, one coil and the condenser must be good. It must be the other coil that's bad."

I nodded and pointed in the set. "Here's the trouble. The high-band coil has broken open."

Luckily it was only a break on the terminal, and a drop of solder reconnected the coil. Jackie seemed to think it was a pretty tricky piece of work. He liked it so much that for the next few weeks I began getting new business from his friends who lived in the really tough part of town. Though it was unusual, I promoted the new calls anyway. That is, till last week.

Three menacing bruisers came into the shop and one of them spoke up, "Since Jackie's been away we've been out of business. He speaks real good of you. How much do you know 'bout burglar alarms?" END

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NEXT MONTH:

What You Should Know About Swimming Pools

Could *you* have a pool? Which types are good buys? How much do they cost? Where can you put them? How much water do they take? Look for answers to these and many other questions about one of America's fastest-growing fun hobbies in June POPULAR SCIENCE.

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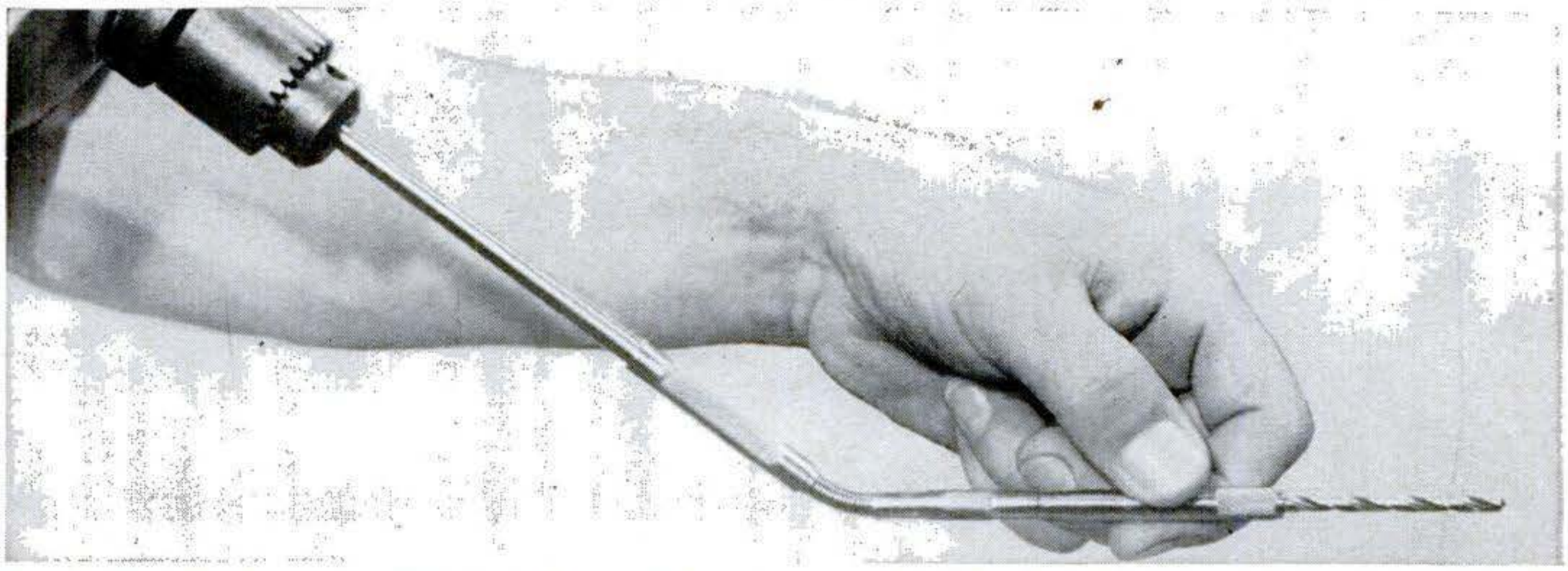
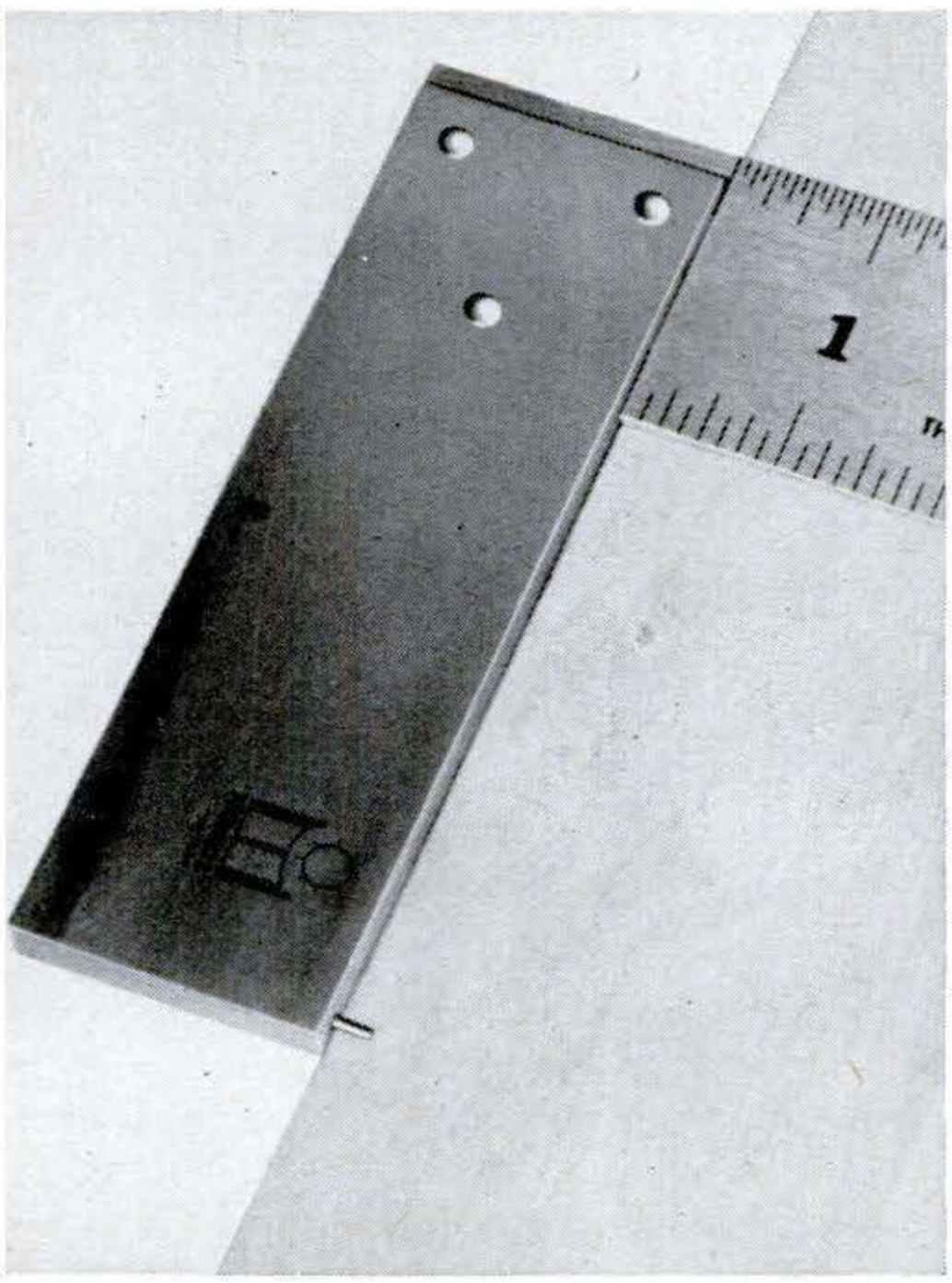
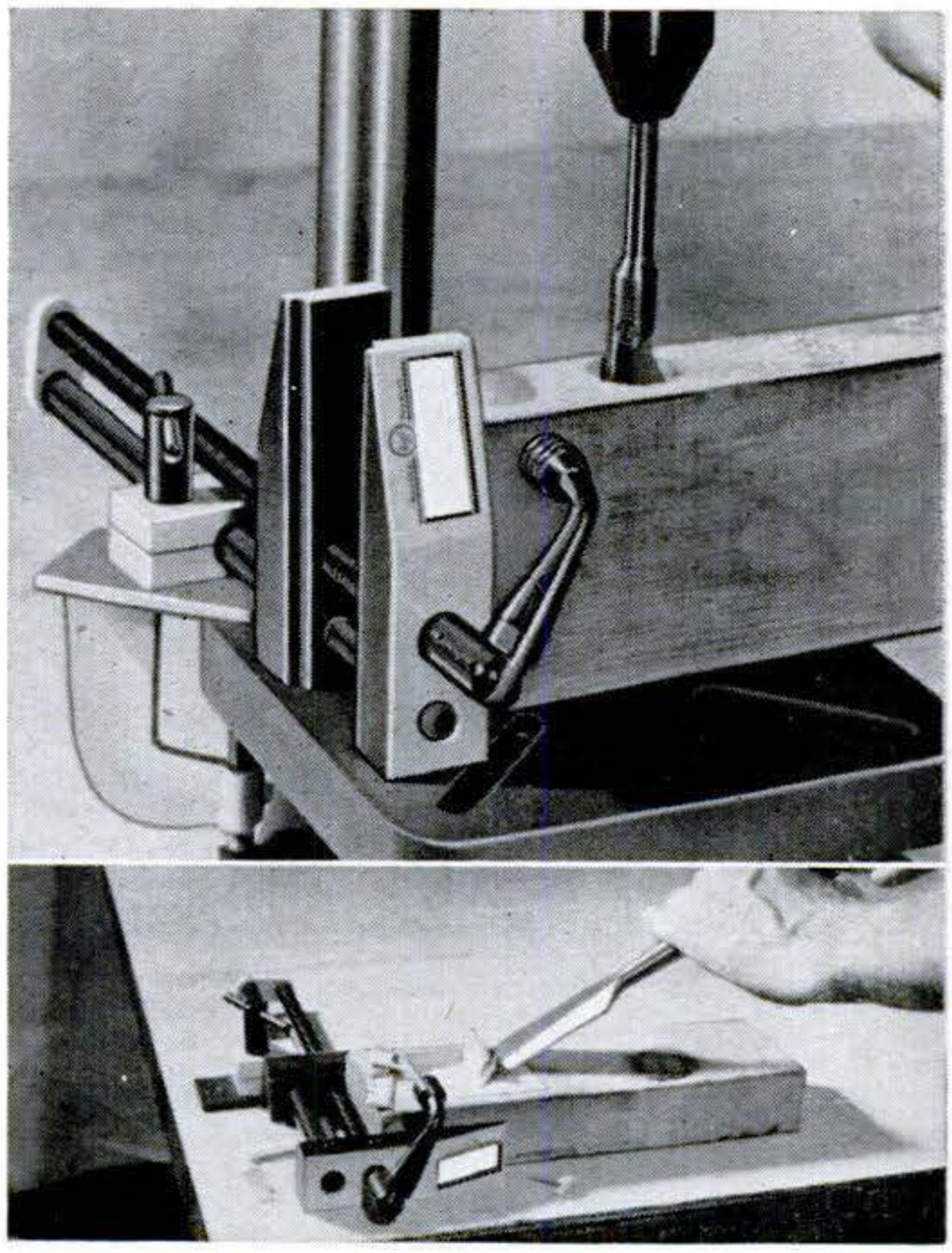
New Tools



1. Drill Extension Works Two Ways. This 10″ extension becomes a flexible drill when you slide a sleeve back to expose a flexible joint. Slide the sleeve forward, and the joint is locked in a rigid position. You can make the change without shutting off power. Chucks are available to accommodate 52 regular bit sizes.



2. Peg Holds Square Flat on Work. This maker of squares has added a small peg inside its try-square handles so you don't have to keep one hand on the handle in order to make the blade lie flat on the piece being marked. Try squares in 9″, 12″ and 14″ sizes are manufactured with the line-up peg in the handle.



3. Bench Vise Clamps on Power Tools. Locked in a threaded base plate inset in a bench, this vise can be used on top of the bench or off its edge by adjusting the extension rod. Take it off the base, and you can thread it to a clamp on a drill-press or saw table, or use it as a large wrench, work clamp or the like.

More information *about the new tools shown on this page can be obtained from: 1. Beaver Tool Co., P.O. Box 256, Huntington Station, N.Y.; 2. Fairgate Rule Co., Cold Spring, N.Y.; 3. DeWalt, Inc., Lancaster, Pa.*

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The Truth About 'Plastic' Paints

Unproved claims—and impressive facts, too—sold 16 million gallons in 1956. Here are tips for you.

By Bernard Gladstone

ENTER any paint store nowadays and you're likely to hear amazing claims for the new "plastic" paints. You can accept some as true. But you should be skeptical of others. These products are still so new that they haven't had time to prove themselves.

You'll hear it said, perhaps, that they can be used both indoors and out. That's true. But not for all jobs. Reliable authorities are still hesitant about recommending them for wood siding. And although they're fine for new concrete or stucco, you're asking for trouble if you apply them over old powdered-type cement paints or any dirty or chalking painted surface.

Before you dip into a can of "plastic" paint, then, you should know what its characteristics are, the ways in which it is superior to other paints, and where *not* to use it.

What are plastic paints? Today two types of "plastic" paint are on the market. One has a polyvinyl-acetate base that is chemically related to the vinyl plastics used in floor tile. The other has an acrylic-resin base related to such clear sheet plastics as Plexiglas and Lucite. Both are actually latex*-type emulsions which in many respects resemble their popular older cousins—the rubber-base latex paints.

**In the paint industry, "latex" meets the dictionary definition: "a milky fluid," and should not be confused with rubber. A plastic-base latex paint is one containing emulsified plastic; a rubber-base latex paint is one containing emulsified rubber.*

Similarity to rubber-base paints. Like their predecessors, plastic latex paints use water as a medium, and are practically odorless. They are easy to apply—even over porous and highly absorbent surfaces. You can put them on with either a roller or a brush. They dry flat and leave no lap marks. They are also extremely fast dryers. The polyvinyl acetates, or PVAs as they're called, take about two hours, and the acrylics less than one. This means that you can do many two-coat jobs in a day. On outdoor work it's even possible to cover an area twice before shifting the scaffolding to a new location.

When thoroughly dry, both plastic-latex paints have a high resistance to staining, and can be scrubbed over and over again without doing any harm to the surface.

Also, because the plastic-latex paints use water as a medium, cleaning up after painting is an easier chore.

How the new paints differ. In their washable properties, the plastic-latex paints are even more durable than the rubber-base flats. If necessary, they can be scrubbed a few hours after they are applied.

Both types dry by evaporation of water, rather than through the usual oxidation process. This means that little or no chemical change takes place. As a result, plastic-latex paints are highly fadeproof, even when exposed to direct sunlight for long periods. It also means that under normal conditions the paint

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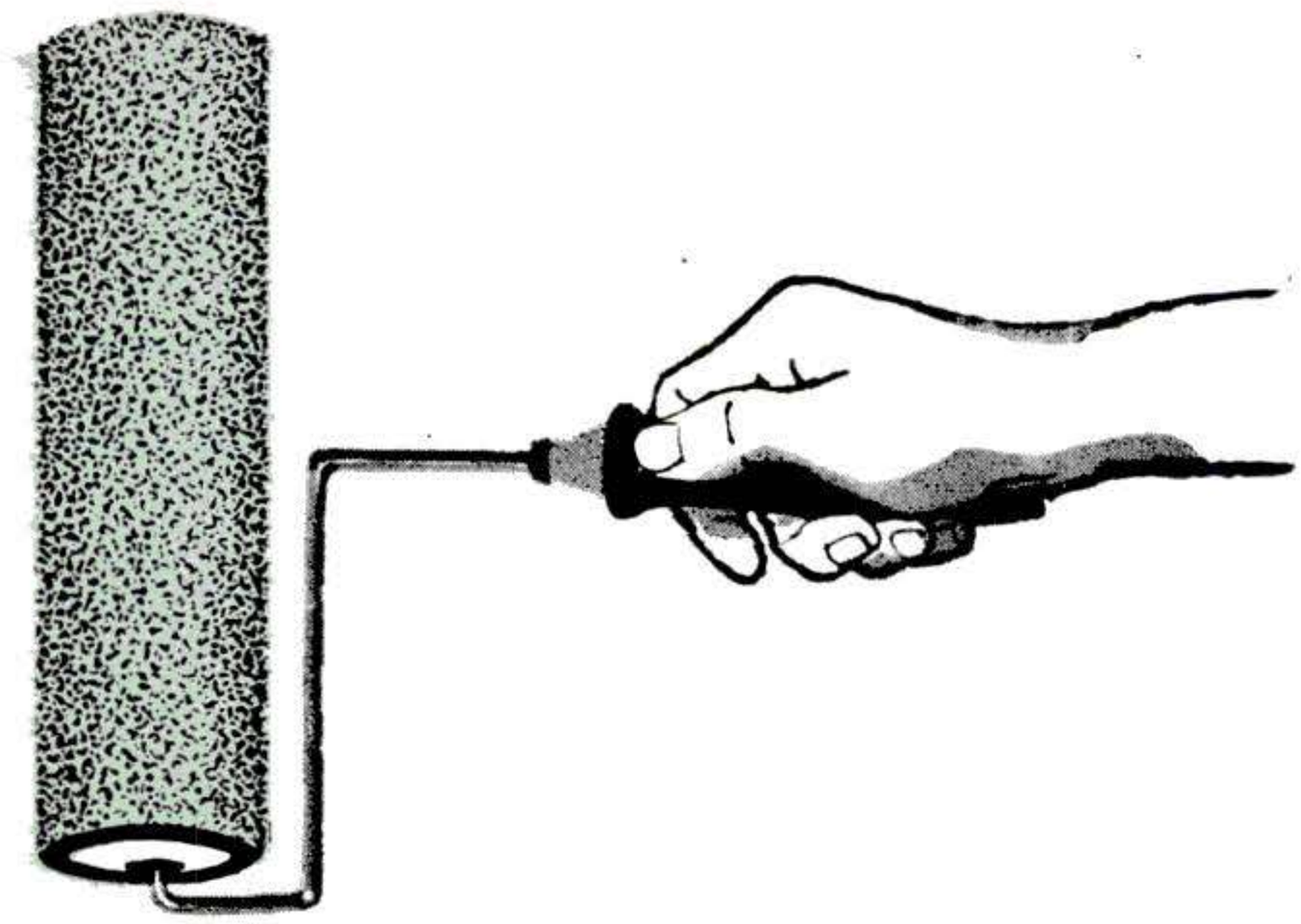

should not become brittle and flake off as it ages.

Another unusual characteristic is that both the PVAs and the acrylics dry with what is popularly called a "breathing" film. In other words, they permit trapped moisture to pass through them in the form of vapor without blistering or otherwise breaking the paint bond. This, combined with a high alkali resistance, makes them ideal for painting over fresh plaster or concrete, even when it has not had enough time to become completely dry or to cure.

These properties have put both types of plastic-latex paint out front for exterior use on masonry walls. The breathing film lets you paint even when the weather is damp or humid, because there is no danger of sealing moisture behind the paint. In fact, it's safe to apply them an hour or so after rain—as soon as the surface is no longer sopping wet.

Take care on exterior masonry. While the new paints adhere well to unpainted concrete or stucco, they cannot be applied over powdered-type cement paints, or to any other previously painted surface which is chalking badly or covered with dirt. Walls of this kind must be scrubbed down thoroughly and wire-brushed to remove all loose material. For guaranteed results the masonry should be sandblasted. This is expensive, of course, but in the case of an old, all-stucco house it may well be worth the cost in the long run.

Experience has also shown that while these paints are usually excellent for use over asbestos shingles, they do not bond well if the shingles are glazed and have not had a chance to weather. So if you plan to paint asbestos shingles, play safe by waiting until they have been exposed to the weather for at least six months. Then brush them down to remove accumulated dust and dirt before applying any paint.

How about wood? Many manufacturers claim that their exterior PVAs and acrylics are excellent for use on wood siding and shingles, as well as on masonry. Other authorities are not so sure. They feel that wood is too flexible, and that its continual expansion and contraction may cause premature cracking and possible peeling.

There's another factor to consider. Already-painted outdoor wood surfaces are usually either very chalky or very glossy—two conditions that make it almost impossible to get good adhesion with any of the PVAs and acrylics that have been developed to date.

Over raw wood, the potential danger of cracking is even greater. It is further complicated by the fact that many woods will bleed through with yellowish-brown stains that come and go even after several coats have been applied. For this reason, most manufacturers who *do* recommend these paints for exterior wood surfaces also advise using an oil-base prime coat first.

Interior painting. Indoors, the plastic-latex paints are fine for practically

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any job calling for a flat finish. They can be used to repaint walls and trim formerly covered with either oil or rubber-base latex paints. On new wood it is again advisable to apply an oil-base prime coat to prevent possible stain-through.

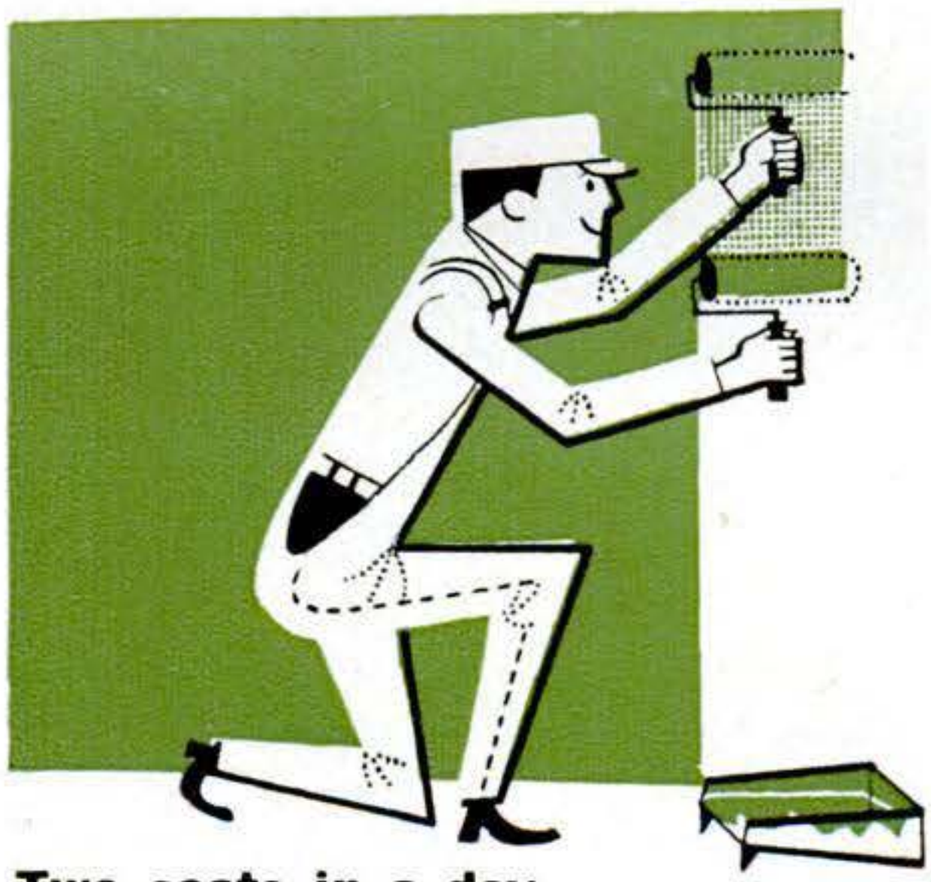
They should not be used over calcimine or water-soluble paints. If in doubt about a particular surface, wipe a small area with a damp cloth. If there is no rub-off, it's safe to use them.

Be wary of "all-purpose" paints. A few of these new paints are advertised as "all-purpose"—that is, good for both exterior and interior work. It is true that plastic-latex bases can be used to make either excellent exterior, or excellent interior paints. But the best formulas for each type should differ in many respects—particularly in the percentage of pigment used. To produce a paint suitable for both purposes the formula has to be somewhere in between. Most experts in the field take a dim view of such compromises, pointing out that you're not getting the best type of paint for either use.

Nevertheless, research in the plastic-latex paint field is still going on at a fast pace and improvements are constantly being made. The backlog of experience is growing, too. In spite of the fact that the PVAs did not really get started in this country until 1951 and '52, and the acrylics until 1953, approximately 16 million gallons were sold last year. So it's entirely possible that in the not-too-distant future you will be able to buy the ideal paint—one that is foolproof in application, and suitable for use over every type of surface. If it comes it will probably have a plastic-latex base. END

4 Points About the New "Plastic" Paints

Paint on rainy days



Two coats in a day

Ideal for new masonry

Clean brushes in water

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The hit of our daughter's Sweet Sixteen party was this—

Dance Platform in the Back Yard

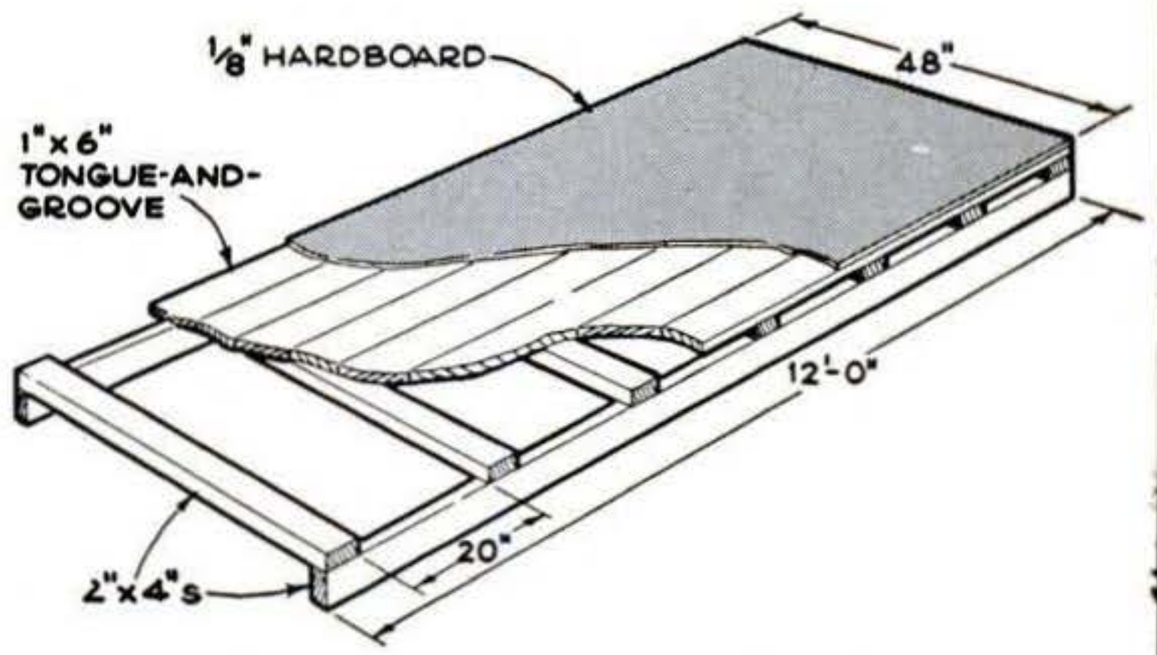
WE BUILT this back-yard dance platform for our daughter's Sweet Sixteen party, and her teen-age friends still throng to it on warm evenings. Large enough for a dozen couples, the 12′-by-16′ floor can be dismantled easily for storage.

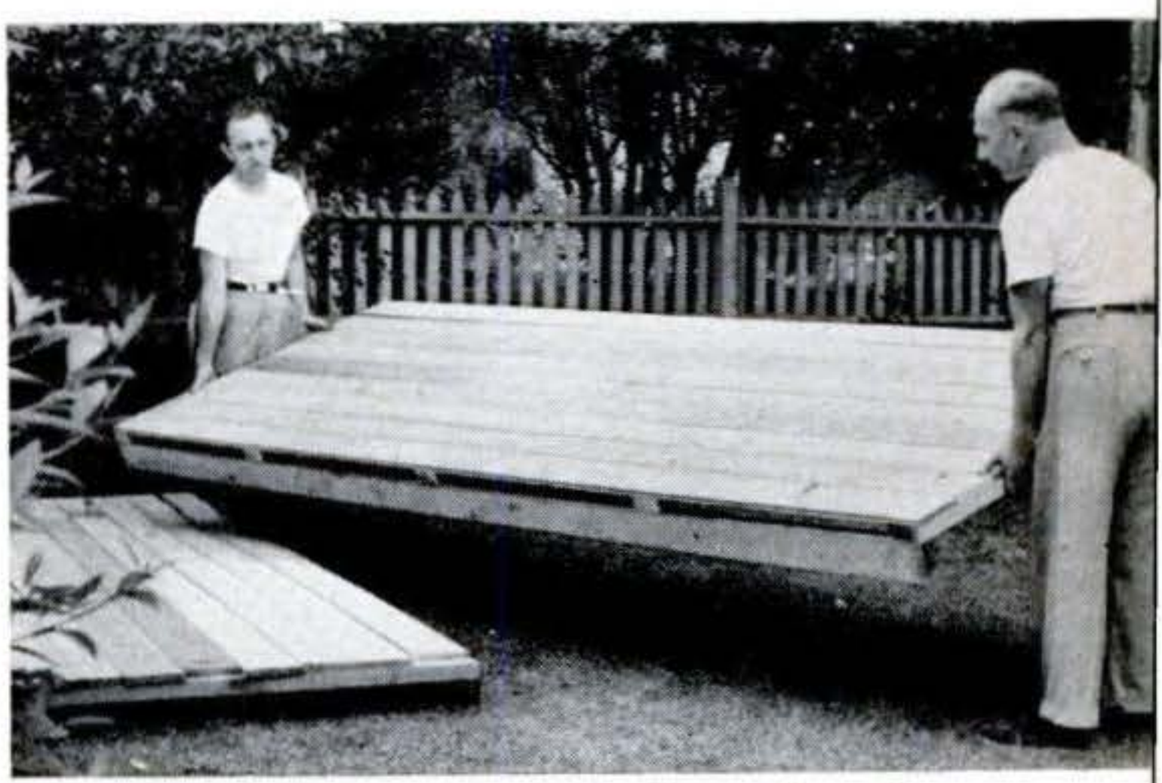
The cost came to less than $60. Materials included 18 two-by-fours 12′ long, rough-cut grade, for the frame; about 200 square feet of subflooring; and six 4′-by-8′s of ⅛″ tempered hardboard.

To make each of the four 4′-by-12′ frames, set two 12′ two-by-fours on their narrow edges, 4′ apart. Saw seven pieces 4′ long and nail them, wide side down, across the two pieces, spacing 20″ apart.

Nail down the subfloor. If tongue-and-groove sheathing is used, avoid fitting the joints too tightly in case the planks swell. Cut and nail on the hardboard. Then bolt the four units side-by-side.

If you plan to dismantle the floor, figure your hardboard so that panels don't run across units.—*Ralph Treves.*





SECTIONS ARE PLACED side by side. If necessary, slip wood scraps or stones under the sections until all rest level and flush. Then fasten them together and put on hardboard.

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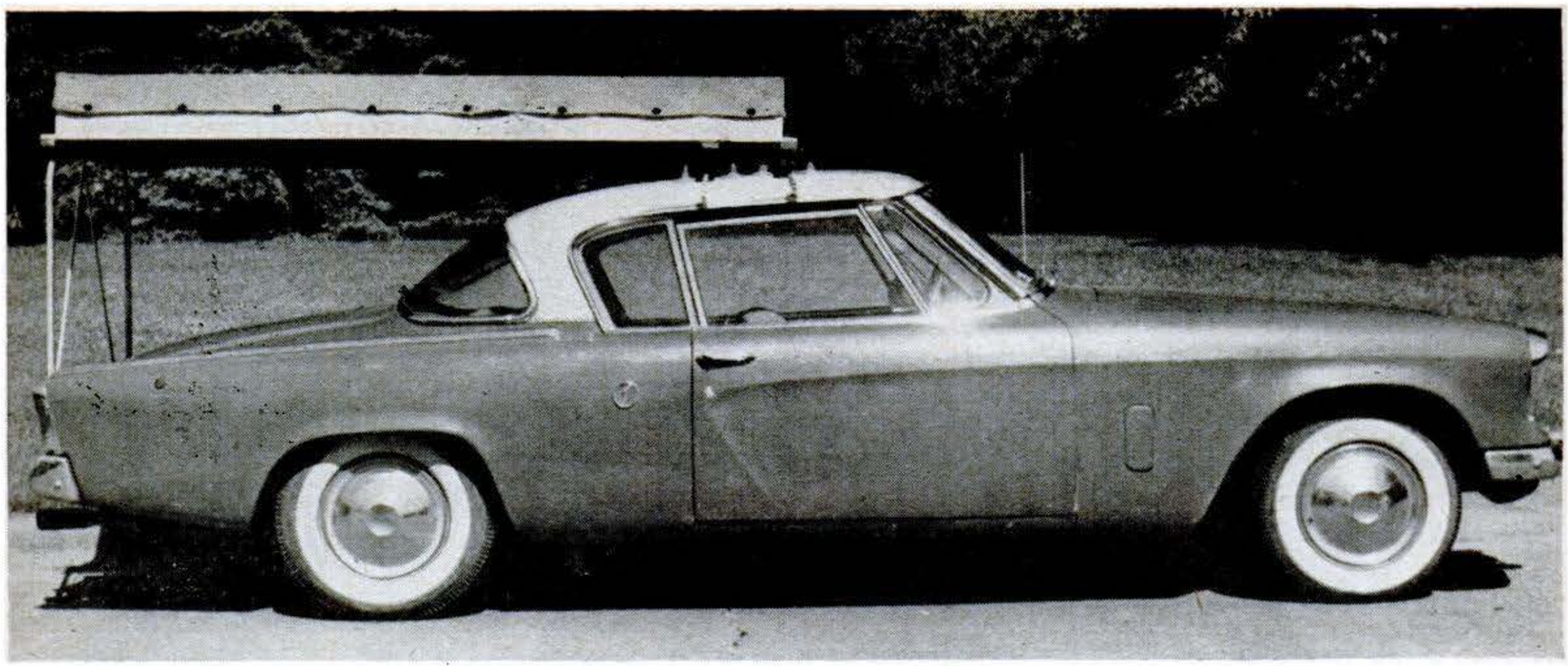

Here's how one man solved the space problem by—

Building a Carrier for Vacation Cargo

A SPACIOUS storage box, bracketed above our hardtop, gives us almost as much space for hauling camping equipment as a small station wagon. We can attach or remove the box and its supporting rig in minutes. Turned upside down, the box becomes a roomy picnic table, resting on legs that slip into pockets at each corner.

I made the forward, box-supporting bracket from two 54″ car-top carrying bars. To hold them parallel I used two aluminum spacer bars, drilled at both ends for eight screws that attach them to the undersides of the wood spreader bars. Other spacers, made of bolts and washers, adjust the height of the suction cups to follow the contour of the car roof and hold the spreader bars on a level plane. Bolts attached to the bars provide anchors for the box, and a pair of safety wires, with hooks that grip the windshield trim, prevent the bracket from creeping backward.

For the rear bracket, I bent two lengths of thin-walled conduit into "L"s and joined them at the ends with a pipe-nipple plug to form an inverted "U." Other pipe-nipple plugs reinforce the lower ends of the bracket, where I drilled holes for a bolted connection to the car's rear bumper. Diagonal aluminum straps, pivoted to the bracket legs just above the bumper bolts, and lapped over another bolt at the center of the "U," stiffen the bracket laterally. A wood spreader bar is attached to the top of this bracket with bolts that continue up to form anchors for the rear of the box.

Two wooden runners with drilled aluminum plates at their ends connect the forward and rear brackets to align and further stiffen the assembly.

The box is a simple plywood job, put together with weather-resistant glue and woodscrews. Holes are drilled in the floor to receive the bolts in all three spacer bars. Wing nuts hold the box down after positioning. For a box cover I use a canvas canopy stitched up for me by a local awning maker. Grommets along the edges slip over fasteners spaced at 1′ intervals along the box sides and ends.—*Tom Griberg, Moline, Ill.*

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1½" x 1½" x 32" REMOVABLE LEG
¾" x 2⅜" x 7⅝" CORNER BLOCK
¾" x 1⅝" x 7⅝" CORNER BLOCK
¾" x 7⅝" x 92" SIDES
¾" x 7⅝" x 46½" ENDS
2"
½" x 4' x 8' EXTERIOR PLYWOOD
WING NUTS
2"
CUT AND FORM FROM 1" STRAP IRON
JOIN BRACKET HALVES WITH PIPE NIPPLE AND DRILL ¼" BOLT HOLE
1'
6"
4"
1'
COUNTERSUNK FLATHEAD SCREWS
¼" x 2½" BOLT
1" x 2" x 4' SPREADER BAR
WING NUT
1" x 2" x 6'-10" RAILS
½" x ¾" x 4" ALUMINUM PLATES
¼" x 2" BOLT
6" RADIUS
NUT IN COUNTER-BORED HOLE
¾" THIN-WALL CONDUIT (HEIGHT OF BRACKET DEPENDS UPON CAR)
HOLE FOR ¼" x 1½" PIVOT BOLT
¼" x 2½" BOLT
NUT IN COUNTER-BORED HOLE
54" CAR-TOP CARRIER BARS
¼" x 1" x 12" ALUMINUM SPACER BARS
⅜" BUMPER BOLT HOLES 1" FROM BRACKET END
¼" x 1" ALUMINUM
REINFORCING PIPE NIPPLES

CAR-TOP BOX offers 18½ cu. ft. of storage space. There's no obstruction to driver's view.

REMOVING SINGLE WING NUT releases diagonal braces, giving free access to the car trunk.

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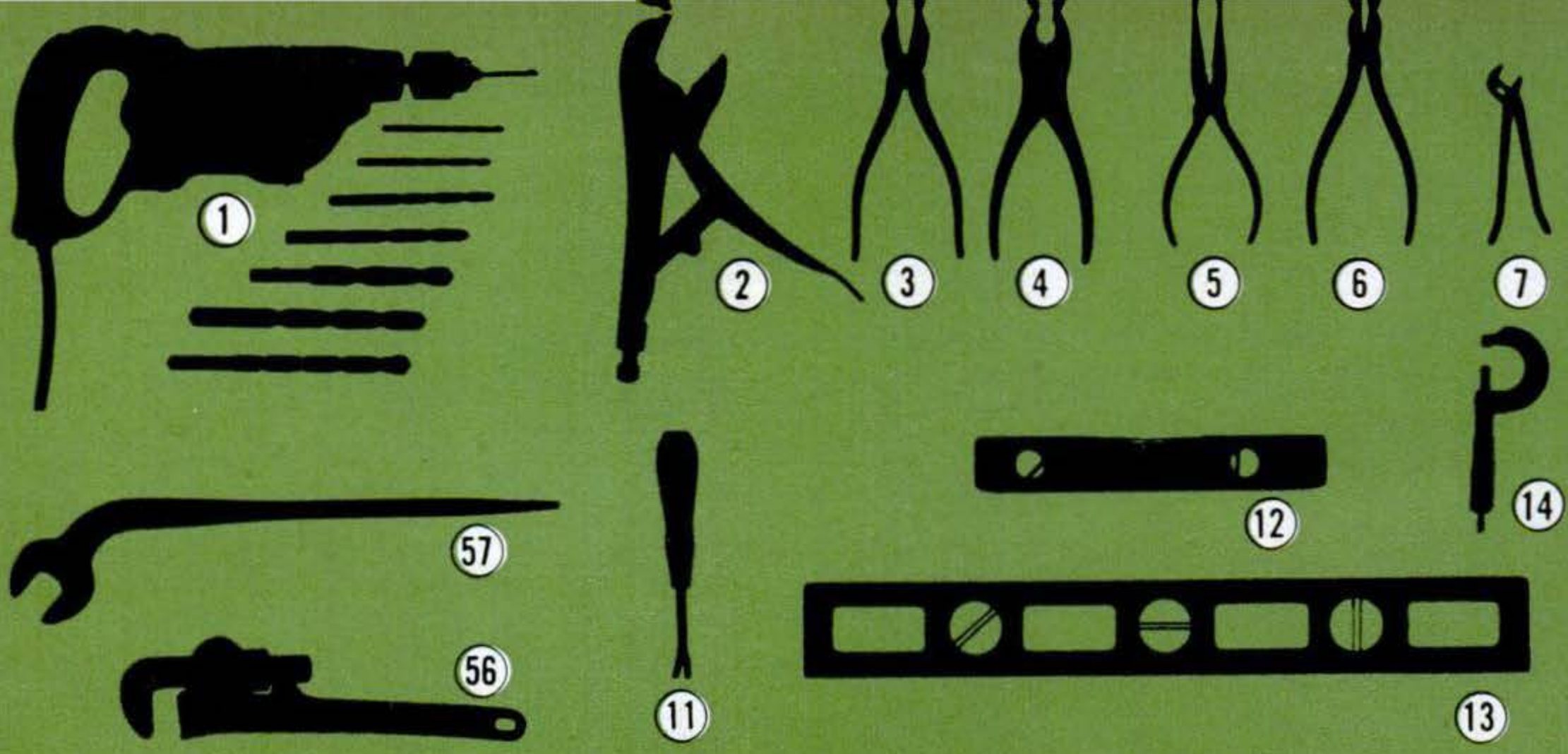
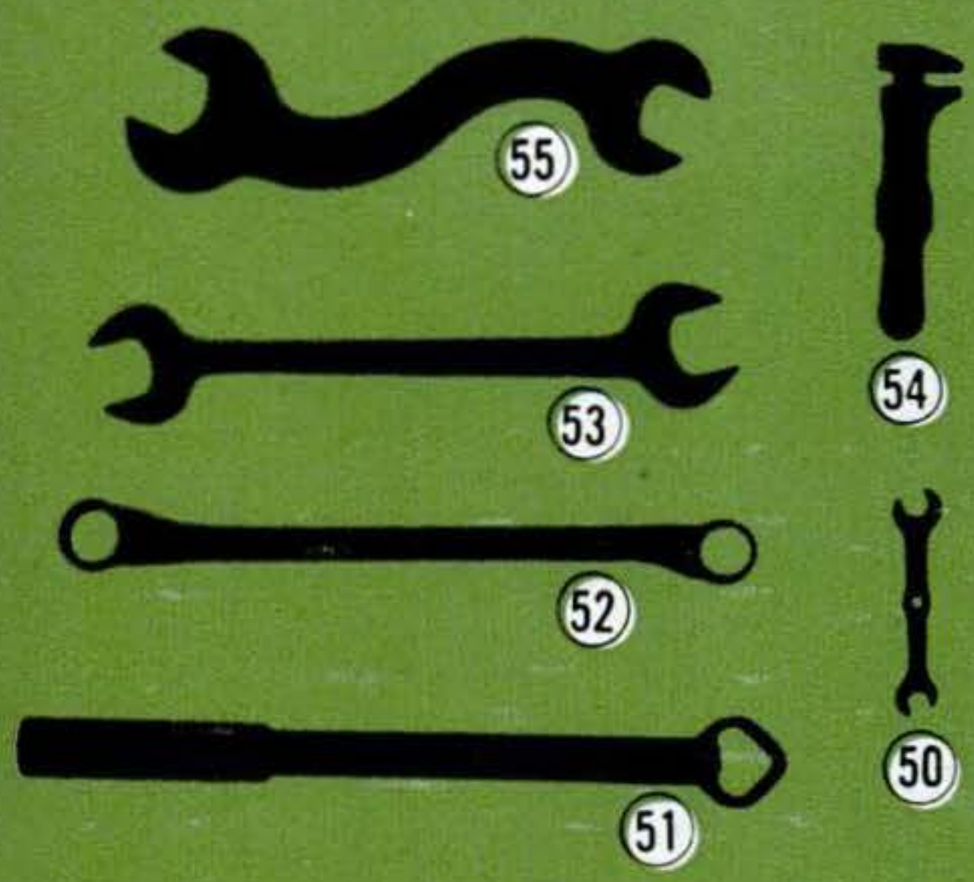


HAND TOOLS . . . *how many*

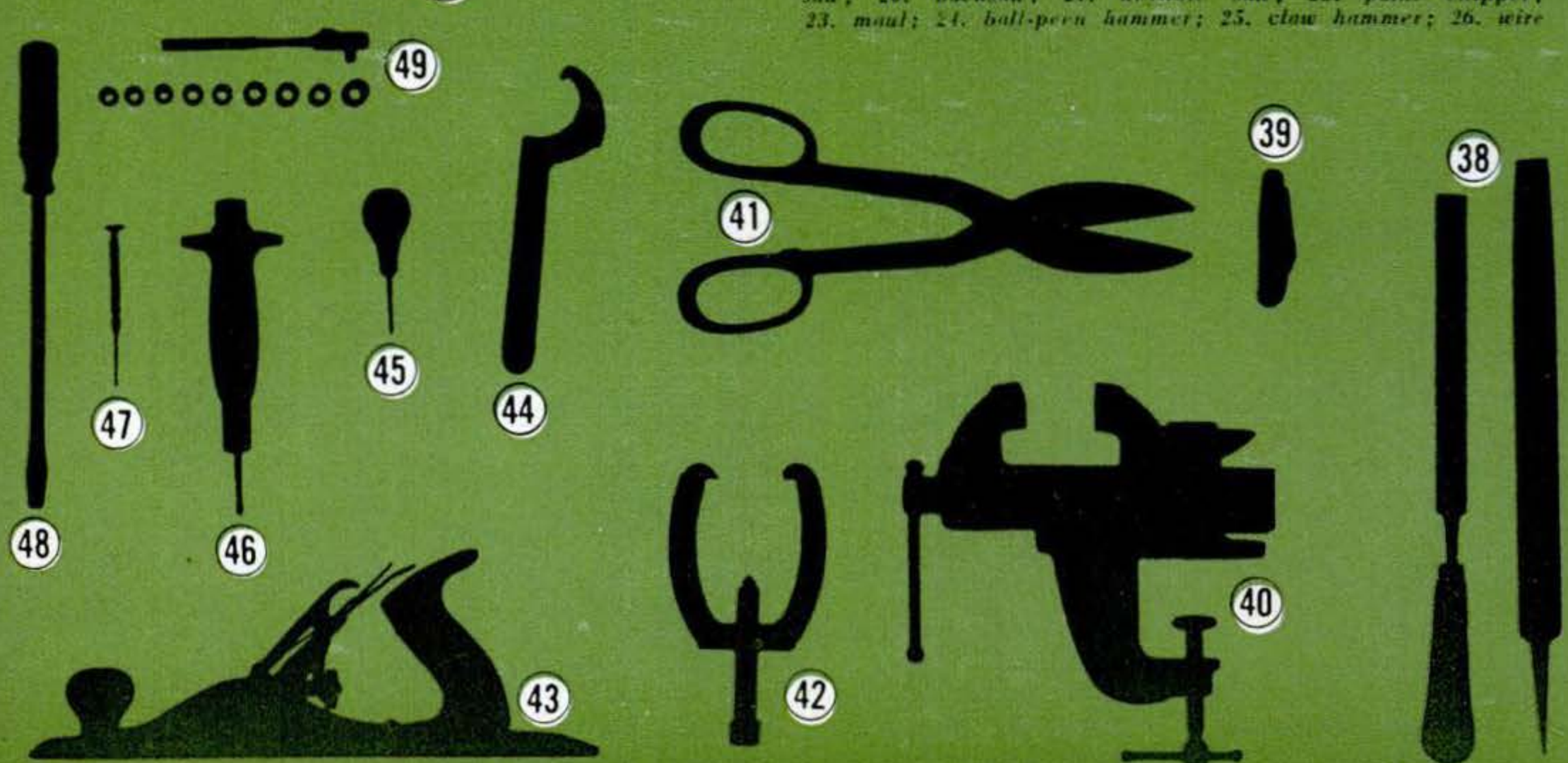


YOU may depend largely upon husky power tools in a home shop. But there are still hundreds of tasks, both in your home and in industry, that call for hand tools.

The 57 shown here are used for doing a wide variety of jobs on wood, plastic,

Here are the answers:

1. Electric drill; 2. lever-jaw wrench; 3. lineman's pliers; 4. slip-joint pliers; 5. long chain-nose pliers; 6. diagonal cutting pliers; 7. pump pliers; 8. outside calipers; 9. fuse puller; 10. cross-cut saw; 11. tack claw; 12. wooden carpenter's level; 13. aluminum carpenter's level; 14. micrometer; 15. wire skinner; 16. saw set; 17. metal punch; 18. dividers; 19. hacksaw; 20. backsaw; 21. keyhole saw; 22. paint chipper; 23. maul; 24. ball-peen hammer; 25. claw hammer; 26. wire



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can you identify?

metal and glass, as well as for electrical, plumbing and machine installations, adjustments and repairs. If you can identify 50 of them you have a well-above-average knowledge of the shop skills requiring hand tools. *(Photo, courtesy E. I. Du Pont de Nemours & Co.)*

brush; 27. square; 28. C clamp; 29. pipe cutter; 30. suction cups for lifting glass; 31. glass cutter; 32. solder pick; 33. putty knife; 34. floor chisel; 35. linoleum knife; 36. horse rasp; 37. soldering iron; 38. wood files; 39. jackknife; 40. clamp vise; 41. metal snips; 42. wheel puller; 43. carpenter's plane; 44. spanner wrench; 45. scratch awl; 46. masonry drill; 47. instrument screwdriver; 48. screwdriver; 49. socket-wrench set; 50. open-end wrench; 51. chisel holder; 52. box-end wrench; 53. open-end wrench; 54. monkey wrench; 55. S wrench; 56. pipe wrench; 57. spud wrench.

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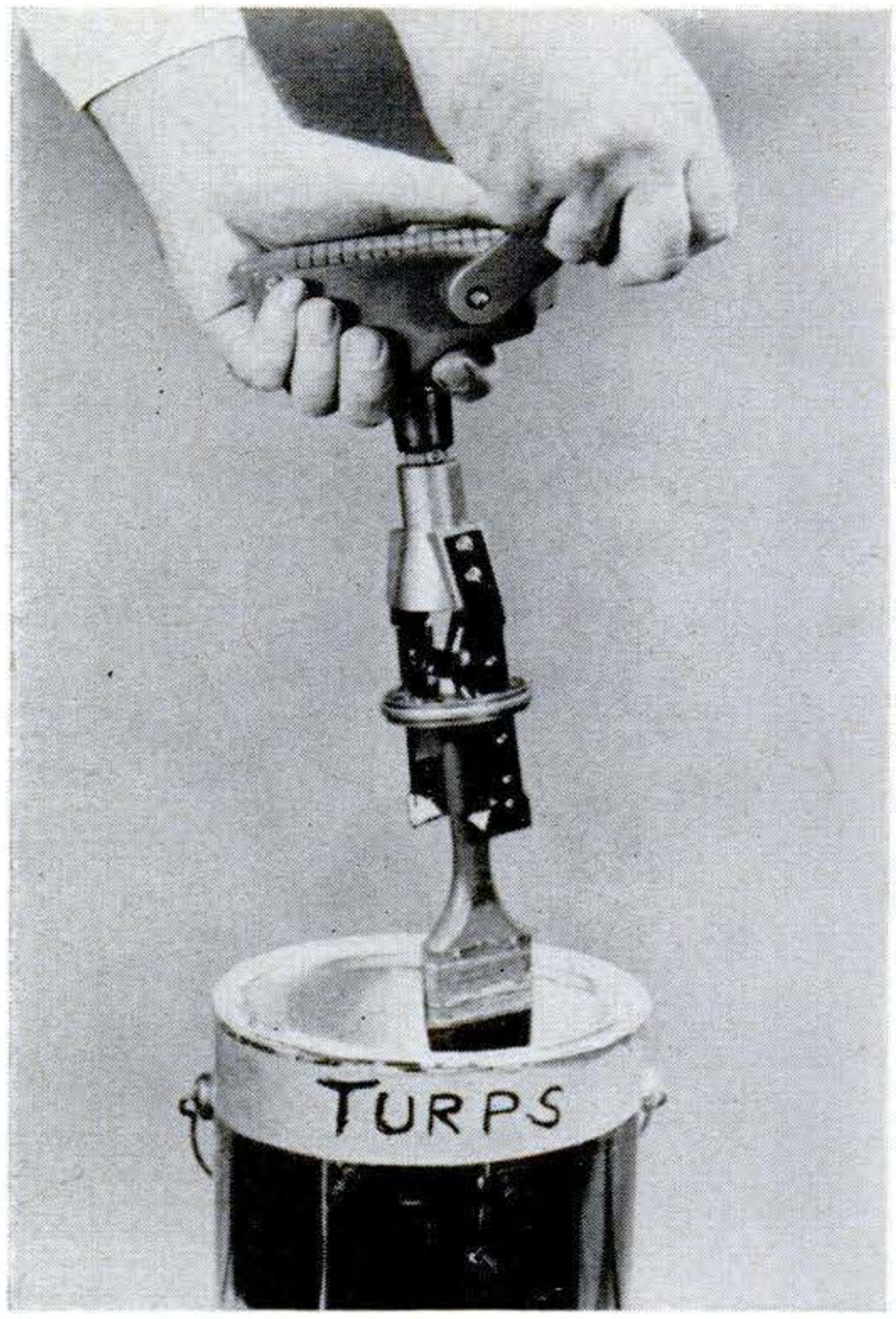
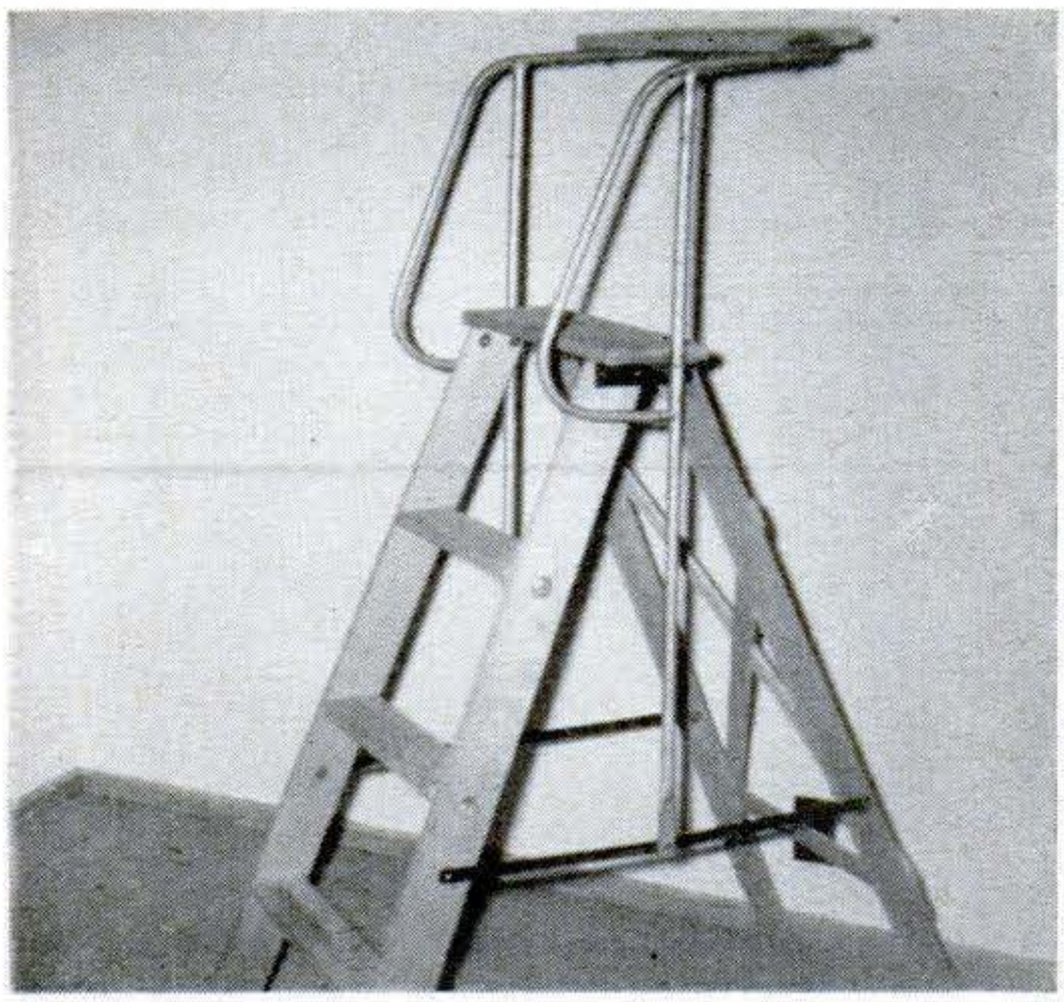
New for the Handyman

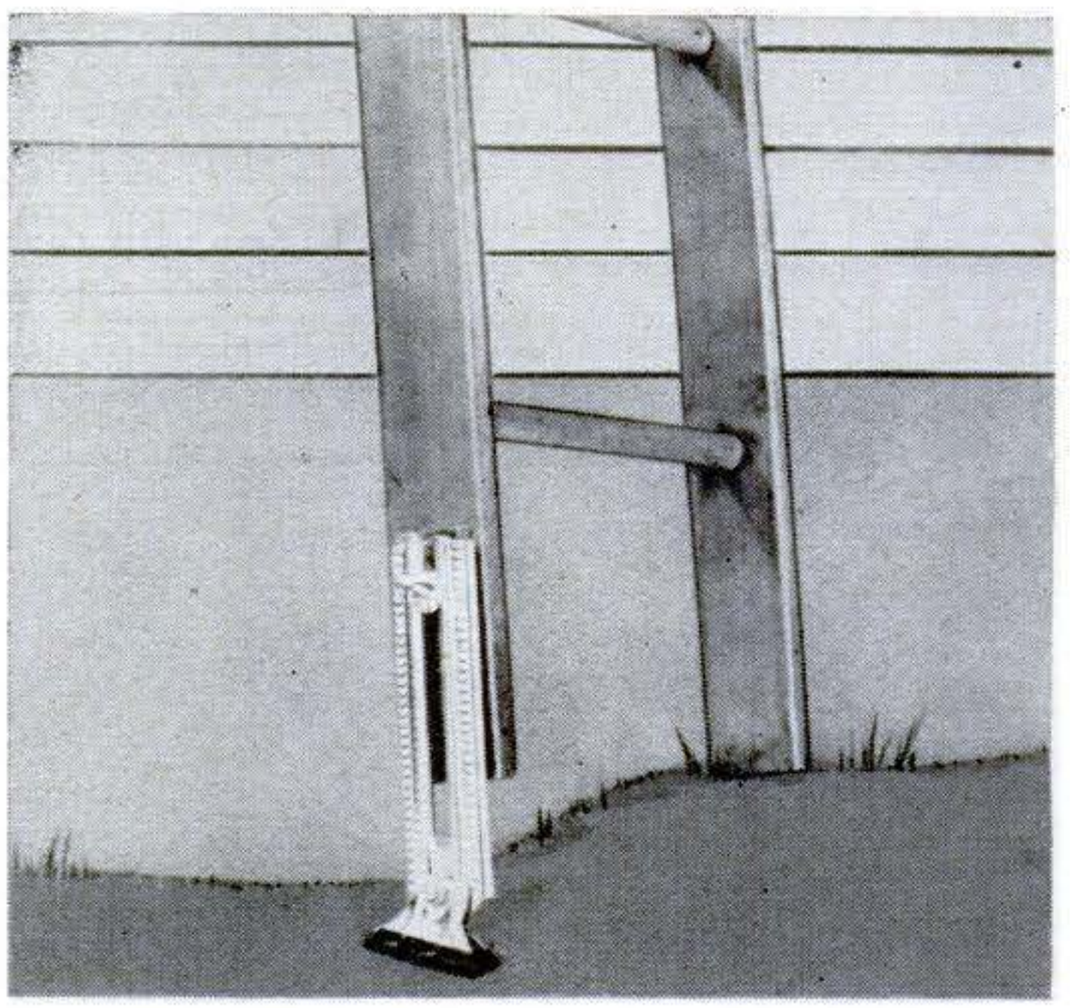
1. Paint Pan Goes Anywhere. A pivoting handle allows this paint pan to hang from a ladder top or rung, or be set on table or floor. It holds up to two gallons of paint and has spaces for you to park roller and touch-up brush.



2. Spinner Cleans Paintbrush. Clamp a brush in this device that works like an eggbeater, and you can spin it clean for the next job in a can of turpentine or other solvent. The tool is said to be a help also in reclaiming old brushes.



3. Step Ladder Has Bench on Top. A folding workbench, on which you can put tools, paint and the like, extends about a foot above the top of this ladder. Its tubular-steel frame serves as a handrail. The bench locks in place when in use.



4. Slide Foot Levels Ladder. With an adjustable steel foot bolted to one of the legs, you can steady a wooden or metal straight or extension ladder on uneven ground. It adds up to 6″ in length or can be used flush with the other leg.

More information *about the products shown on this page can be obtained from: 1. Thomas Products Co., 8490 Lyndon Ave., Detroit 38, Mich.; 2. Portable Electric Tools, Inc., 320 W. 83rd St., Chicago 20; 3. Safe-T-Ladder Co., Huntsville, Ohio; 4. Rolas Products Corp., 69-73 Summit St., Newark 4, N.J.*

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What every table-saw owner should know about—

Setting Up a Saw for Accurate Cuts

A table saw consists of parts bolted and screwed together. If any part slips, even just slightly, you lose the precision that was built into the saw. Therefore, every saw should be aligned regularly. This true story tells how to go about it.

By R. J. De Cristoforo

A MAN we'll call Jim had dropped in to see how his friend Johnny was coming along with the new saw he had just bought. Johnny was leaning hard on the handle of a bar clamp trying to bring two mating edges together before the glue dried. Jim, who has used power tools from 'way back, walked over to the saw and trimmed off the end of a scrap piece of plywood. Then he placed Johnny's square across the cut and held it up to the light.

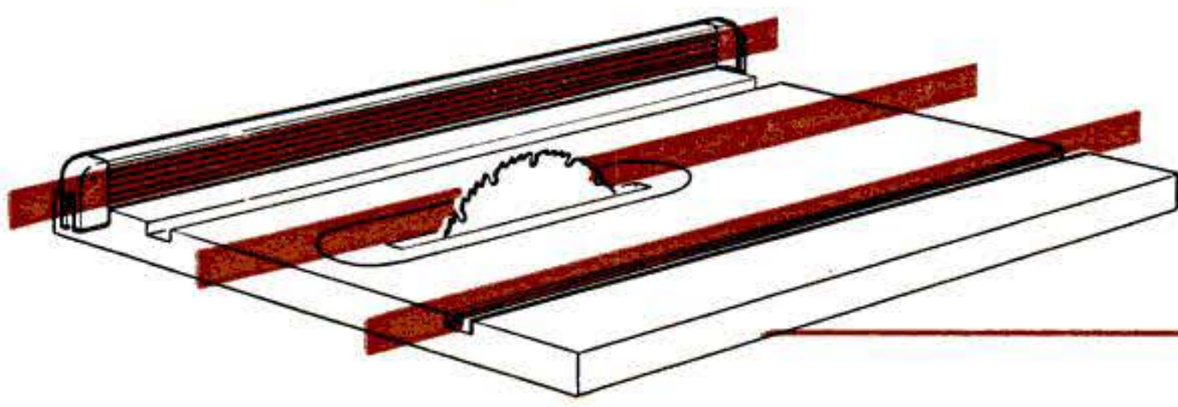
"Yipes!" Johnny said.

"Guess this saw has a bad case of miter-gauge-itis," Jim laughed. He picked up the manufacturer's instruction sheet, still sealed in its clean plastic envelope, from the workbench. "Don't you think we should align this saw?"

Johnny looked puzzled. "But this is a brand-new saw."

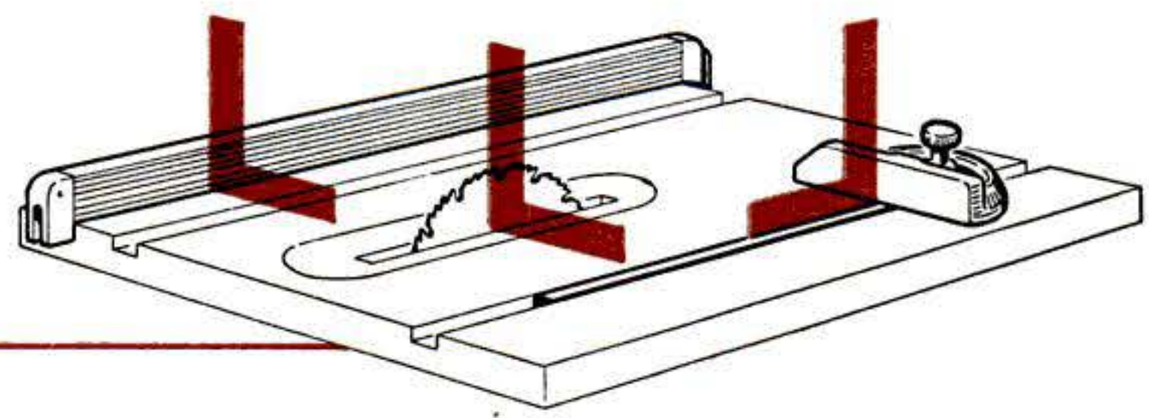
"No matter. In fact, normal usage, which could cause misalignment, is nothing compared to the bounces and

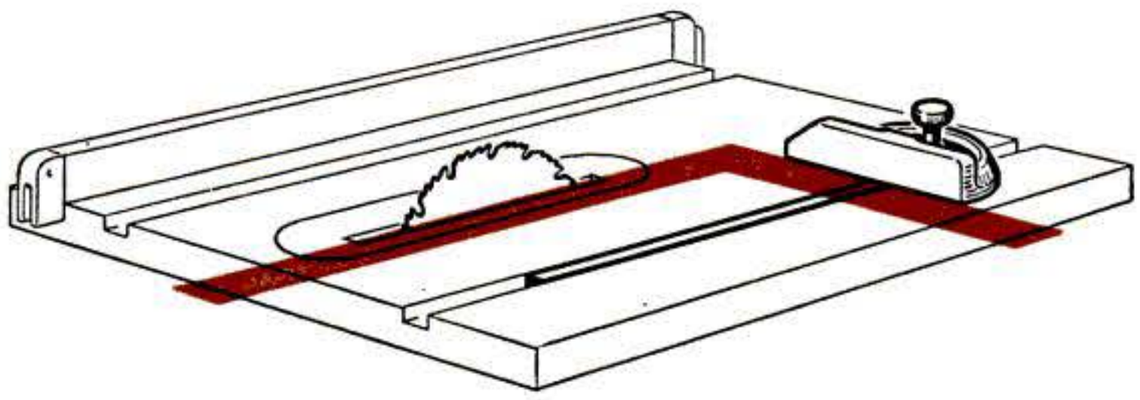
3 Alignment Rules for Any Table Saw



1 THE TABLE SLOTS (in which the miter-gauge bar slides), the rip fence and the saw blade must all be parallel.

2 THE RIP FENCE, the saw blade and the miter-gauge head must all be perpendicular to the table surface.





3 WHEN THE MITER GAUGE is in normal position (90-deg. setting), it must be at right angles to blade and rip fence.

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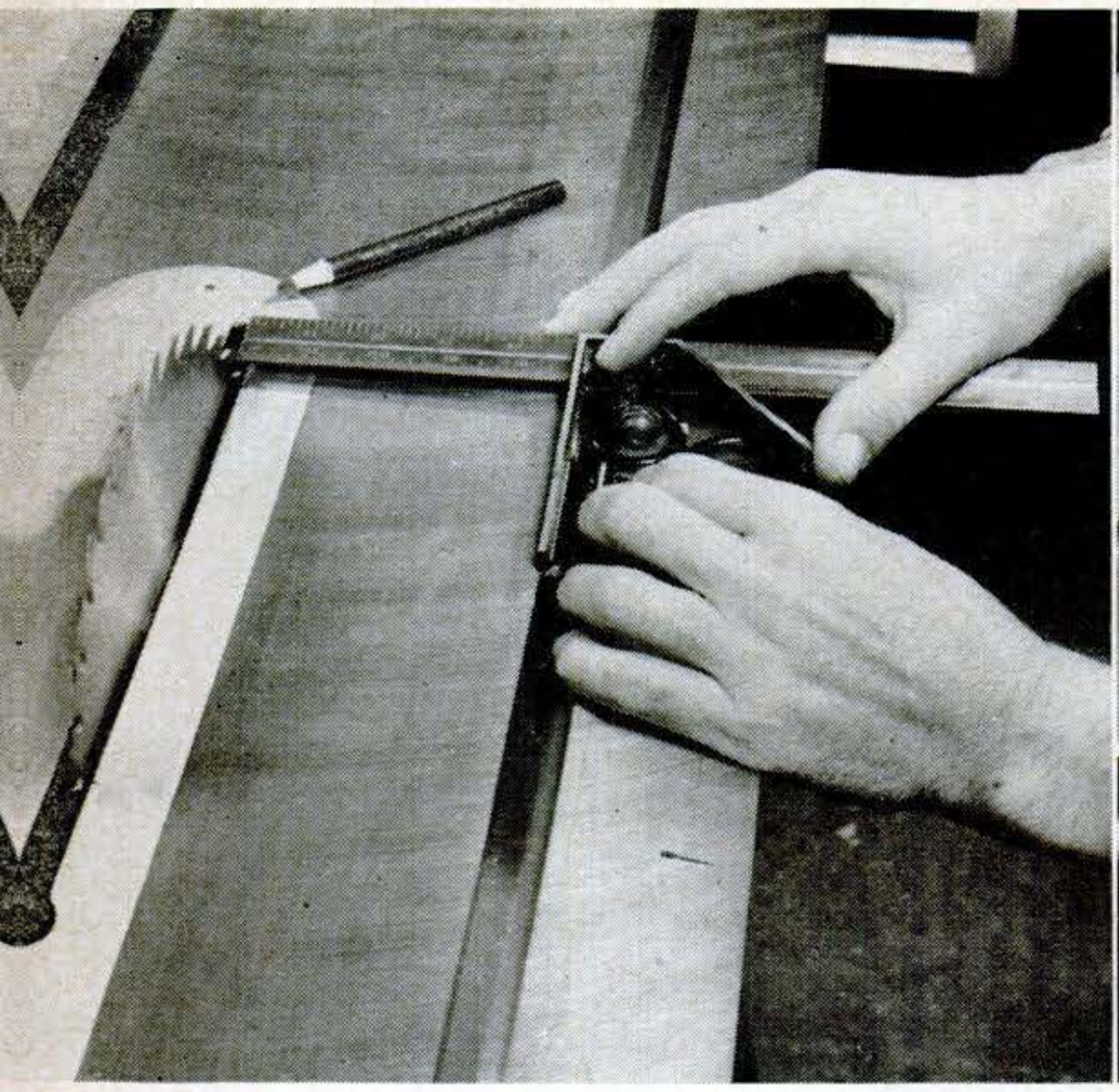
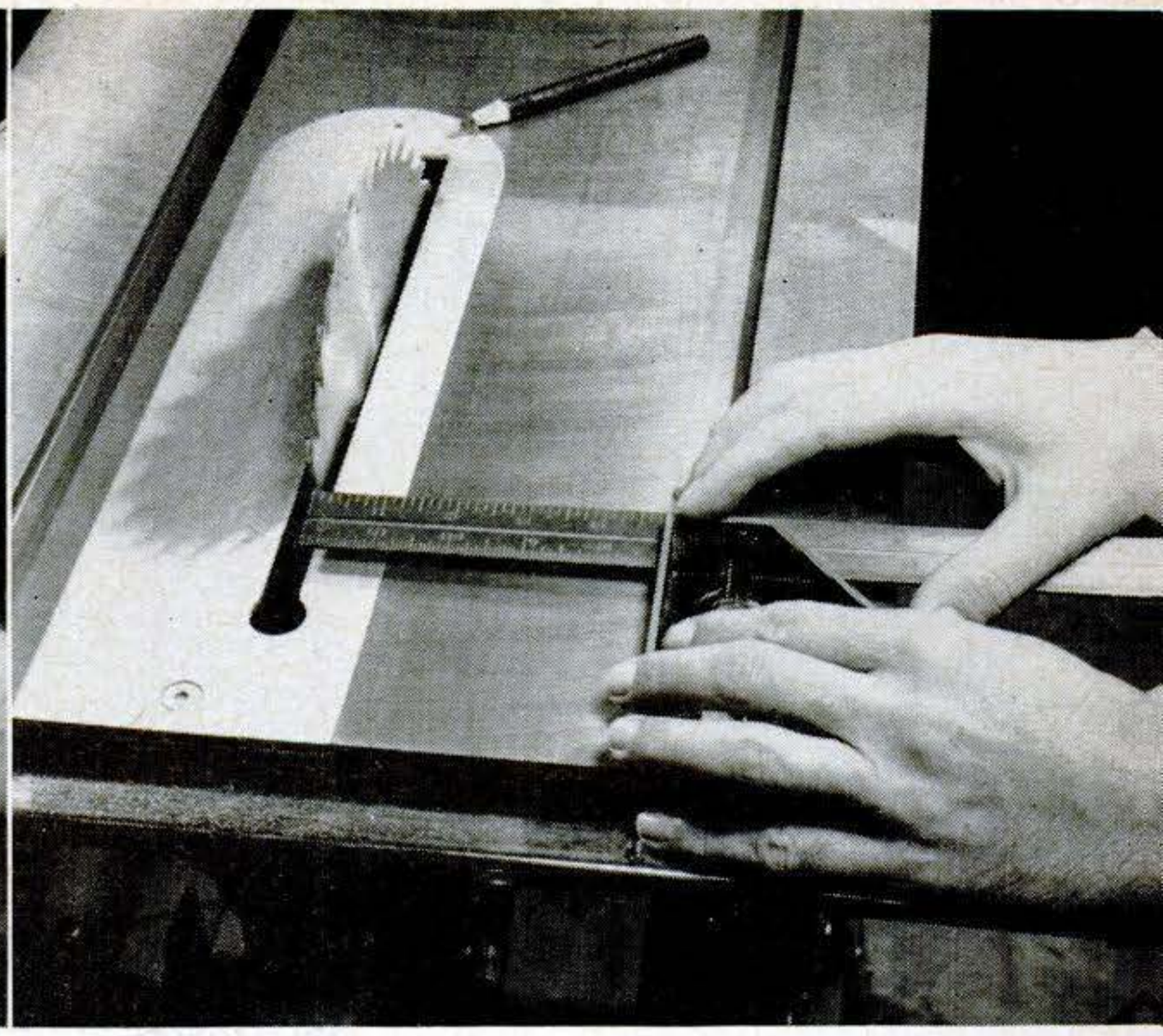
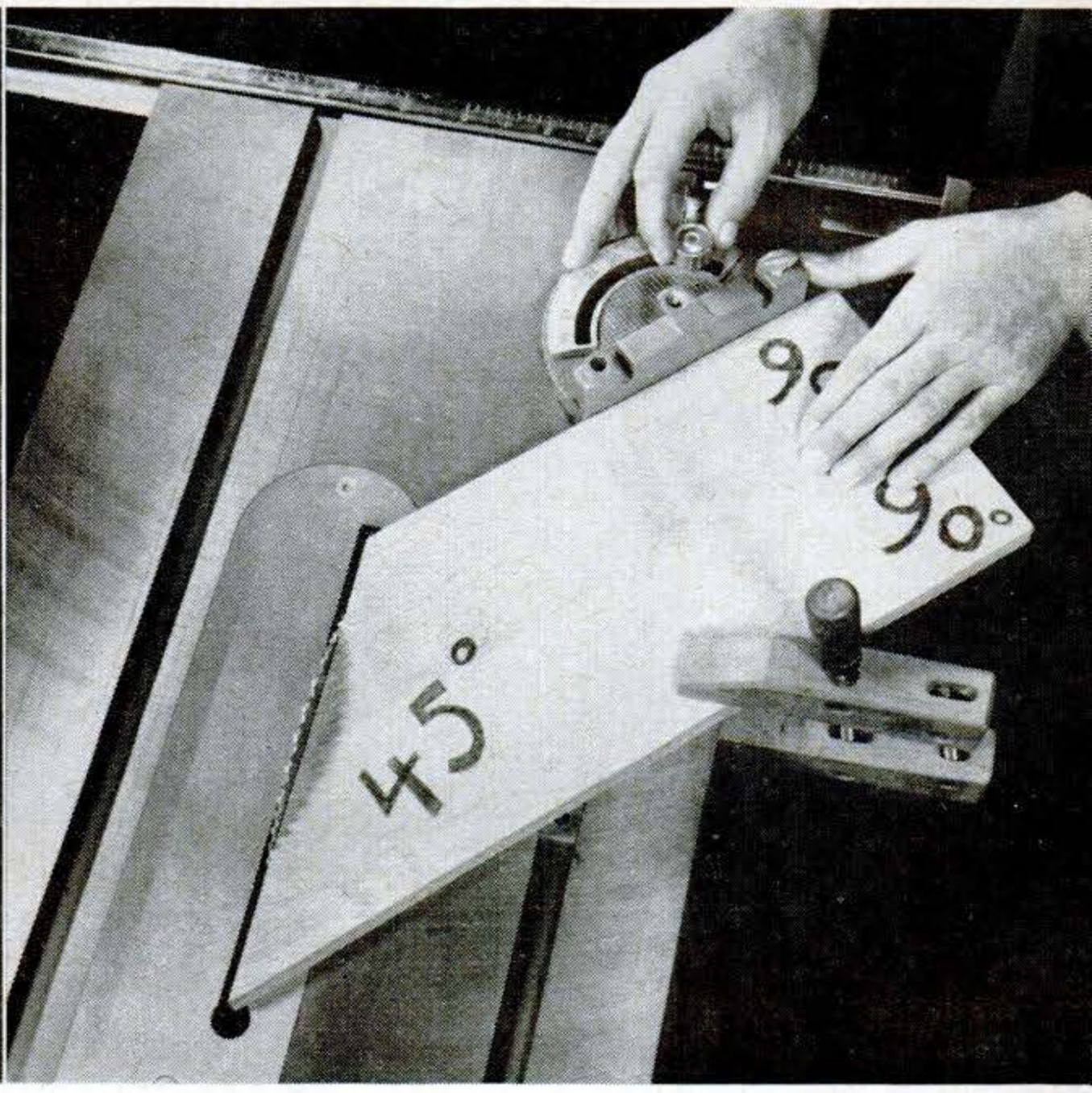




Are the table slots parallel to the blade?

ALL ADJUSTMENTS DEPEND ON THIS. Unless the slots are parallel to the blade, miter gauge and rip fence will be off. To check, hold head of a combination square snugly against side of slot and advance scale until it just touches a saw tooth that has a set toward the square. Mark the tooth, turn the blade and move the square to the back of table to the same relative position. If the scale does not just touch the marked tooth, adjustment should be made.



Does the miter gauge give accurate angle cuts?

CHECK 45-DEG. POSITIONS with a quickly made check block, using ¾″ plywood 6″ to 8″ wide and 18″ long. Square one end and bring the other to a 45-deg. angle by first cutting outside a line and then carefully sanding to it. To use, clamp the block with its mitered side flush against a hollow-ground blade. Move the miter-gauge head flush against the block. Lock the gauge and set the auto-stop. Then flop over the block and repeat for the opposite 45-deg. setting. If the gauge lacks an auto-stop, scribe on the scale the exact location for each 45-deg. setting. Seal the block against moisture and keep it for periodic measurement checks.

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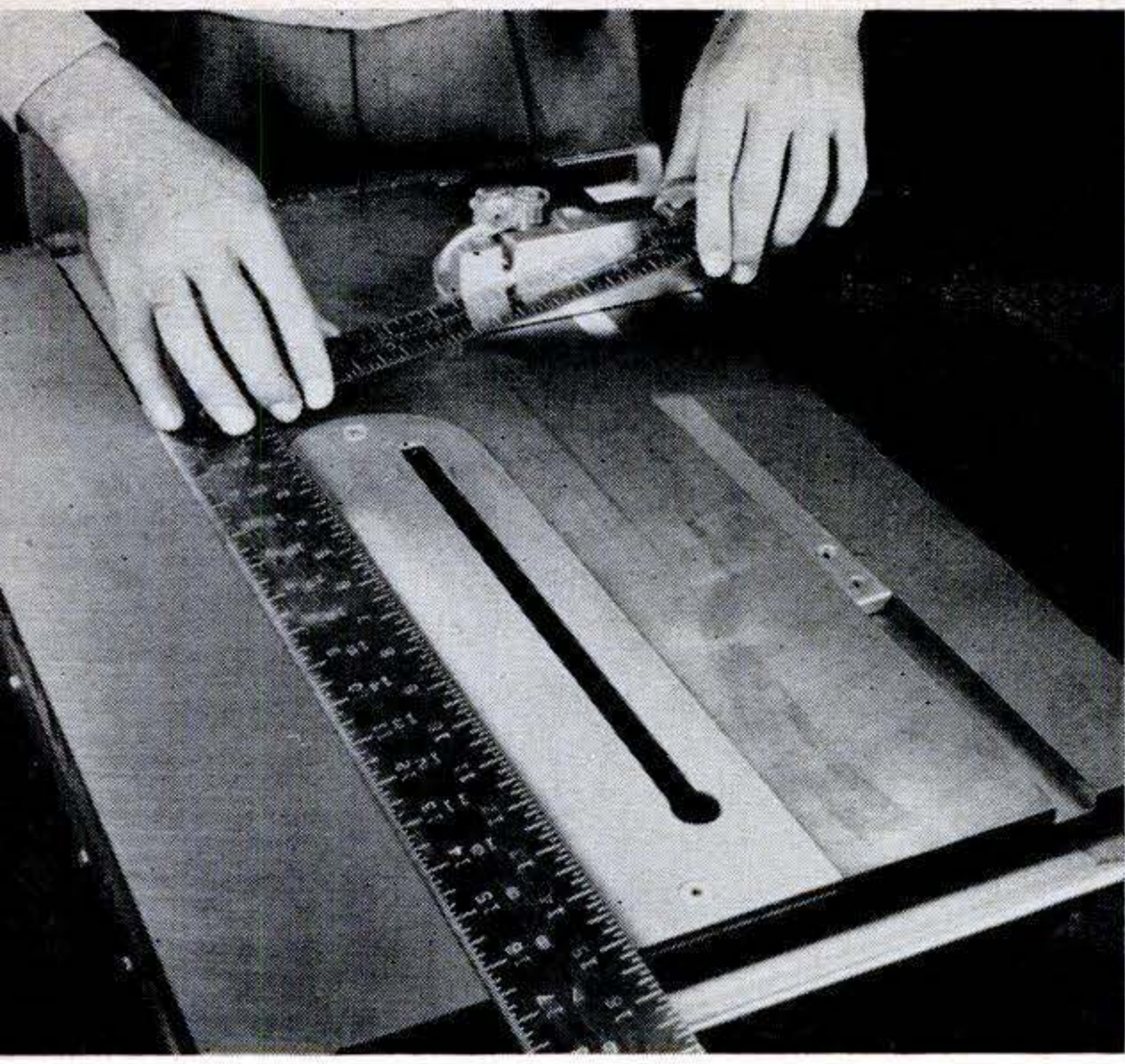

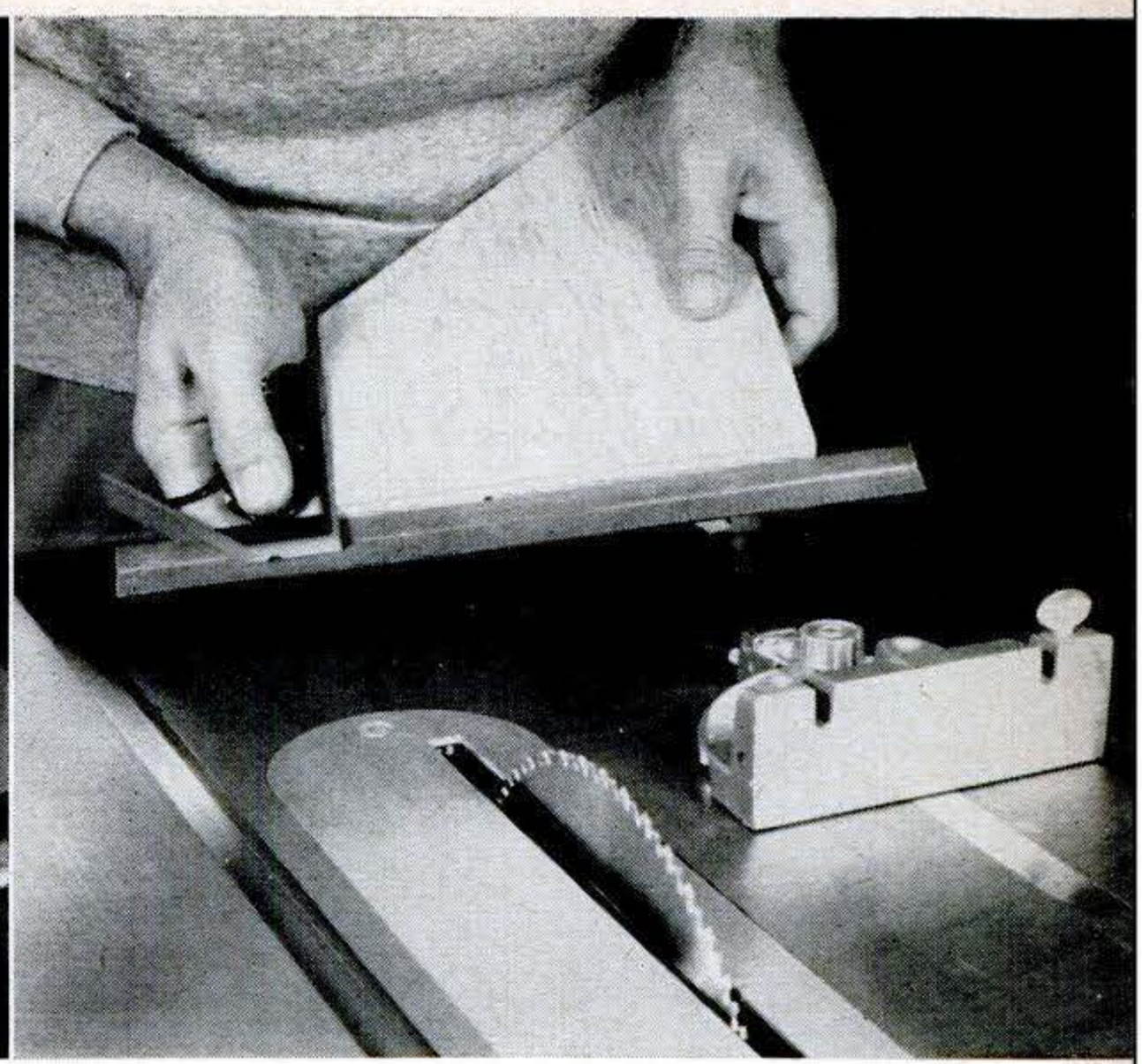

Does the miter gauge give a square cut?

TO CHECK THE 90-DEG. POSITION of the miter gauge, place the long arm of a carpenter's square against the side of one slot. Hold the gauge head flush against the other arm and tighten the lock knob. Adjust the auto-stop at this point if the gauge is so equipped. Finally, to compensate for any wobble of the gauge bar in its slot, make a trial cut and check the cut itself with a square. The squareness of the cut is the ultimate test of the miter gauge's accuracy.

knocks the machine receives in transit."

"Okay," Johnny said. "Where do we start?"

Jim pointed at the blade. "First, we should remember this about the blade:

"Except for raising and tilting, you have no say over the blade's relation to other components other than by adjusting the other components. The accuracy of both the rip fence and the miter gauge depend on how the table itself is aligned with the saw blade. That means you have to be sure the table slots are perfectly parallel with the saw blade.

"Check by using a combination square —head snug against the side of the slot, scale extended so it just touches one tooth at the front of the saw blade. Mark this tooth, rotate the blade backwards by hand, move the block to the back, and make the same check on the same tooth. If the tooth doesn't touch the scale as it did the first time, you know the slot is not parallel to the blade and you've got to adjust."

Johnny studied the gap between the scale and the tooth, and said, "I've got to adjust."

"Uh-huh," Jim said. "But not much. It's off about $\frac{1}{32}''$. You can check your owner's manual later but I'm pretty sure the table is bolted to the tub and that by loosening the bolts we can rotate the table about the axis of the saw blade and so bring the slots parallel."

Jim knocked the rear of the table lightly with the palm of his hand after he had loosened the bolts, and repeated the check with the square. Then, very carefully, taking a turn at a time on each bolt so he wouldn't upset the table position, he cinched up each bolt. And again he checked with the square.

"That's it," he said, finally satisfied. "That's the position it was designed for; the only position in which it will do an accurate cutting job."

"Good!" Johnny said, walking to the saw, miter gauge in hand, "Now let's . . ."

Jim laughed, and said, "Not yet." He took the miter gauge from Johnny and removed a carpenter's square from a cabinet over the workbench.

"Now we know the blade is parallel to the table slots but if we're going to get a 90-degree cut, we've got to be sure

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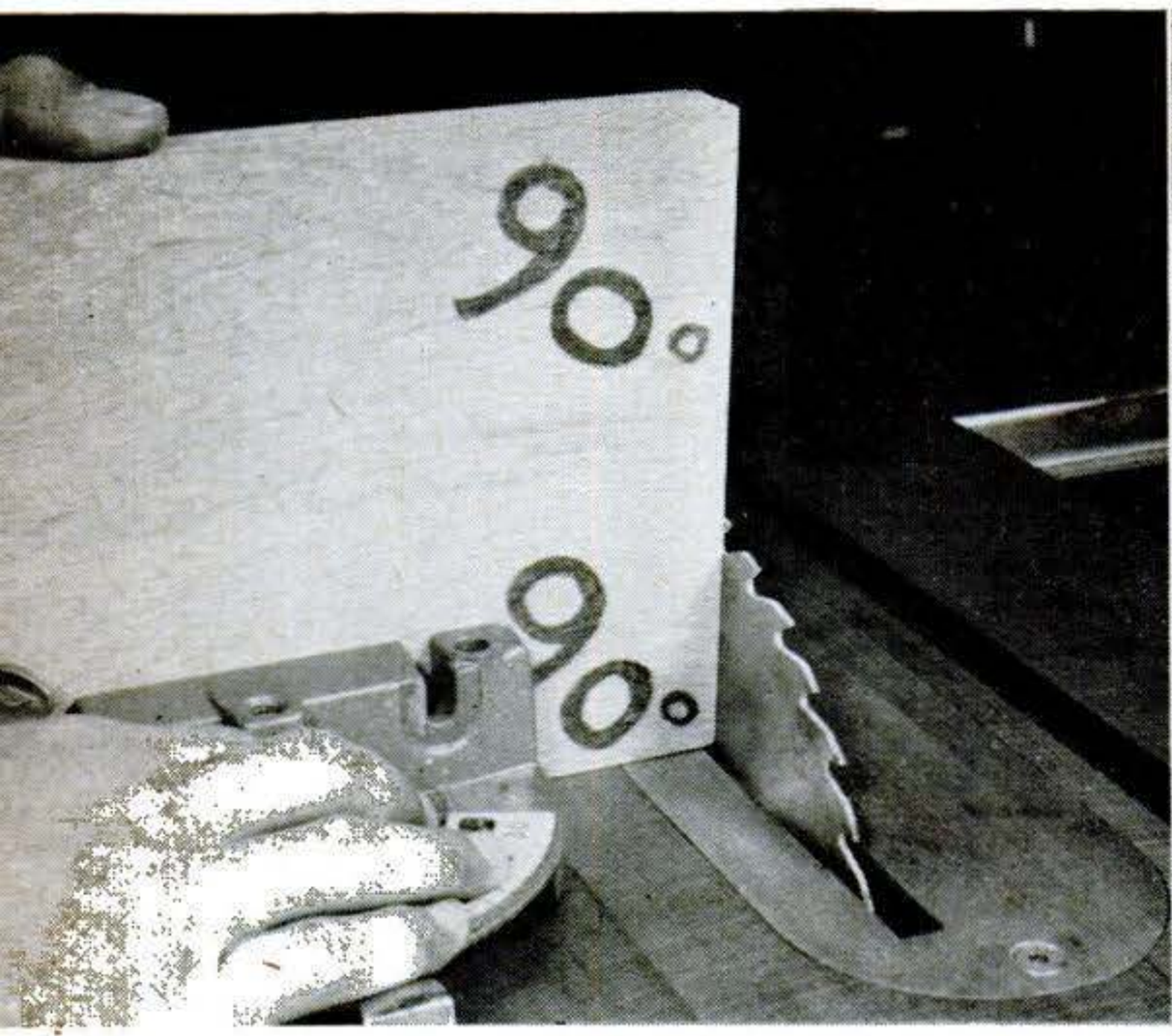
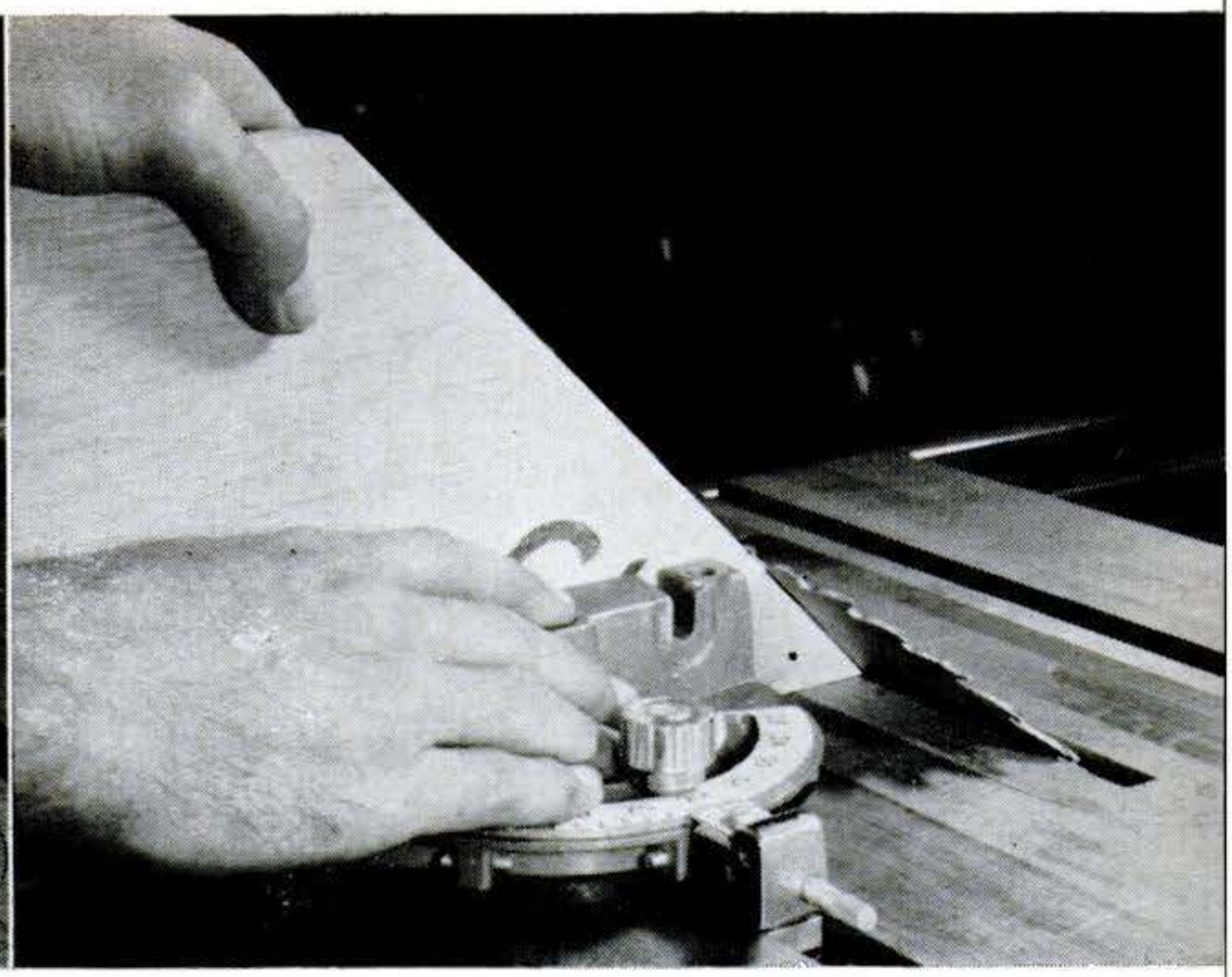




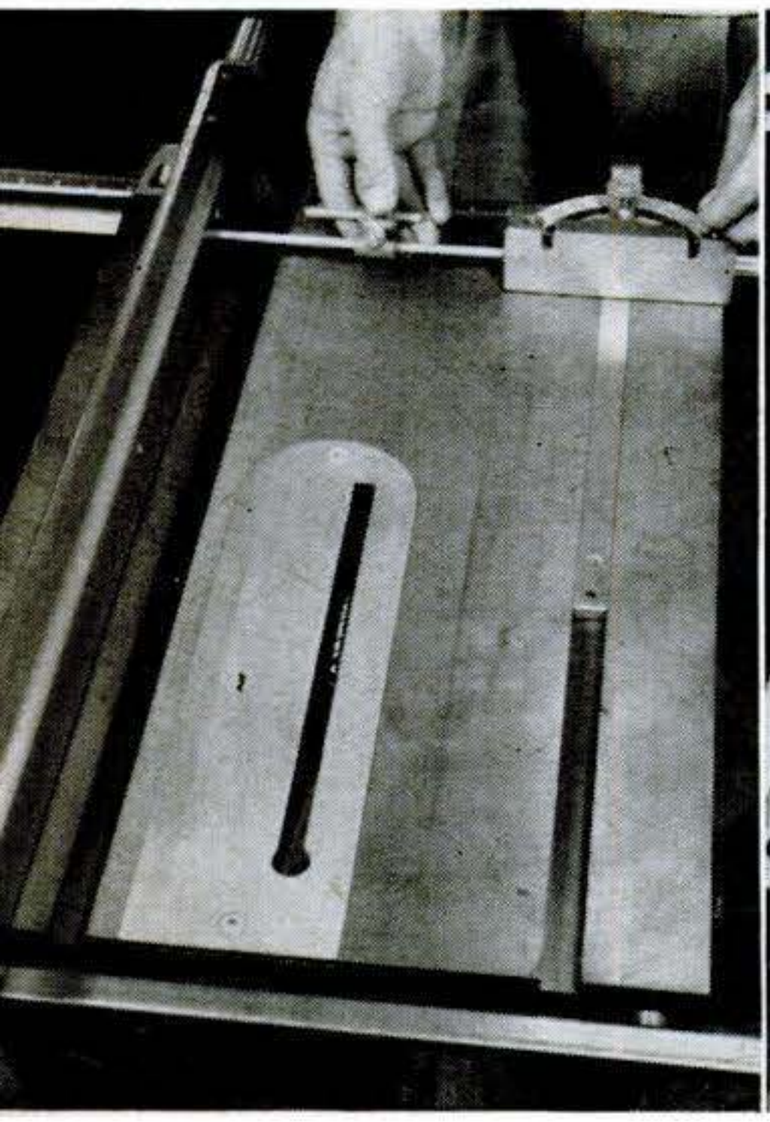
Is the blade tilt-scale accurate?

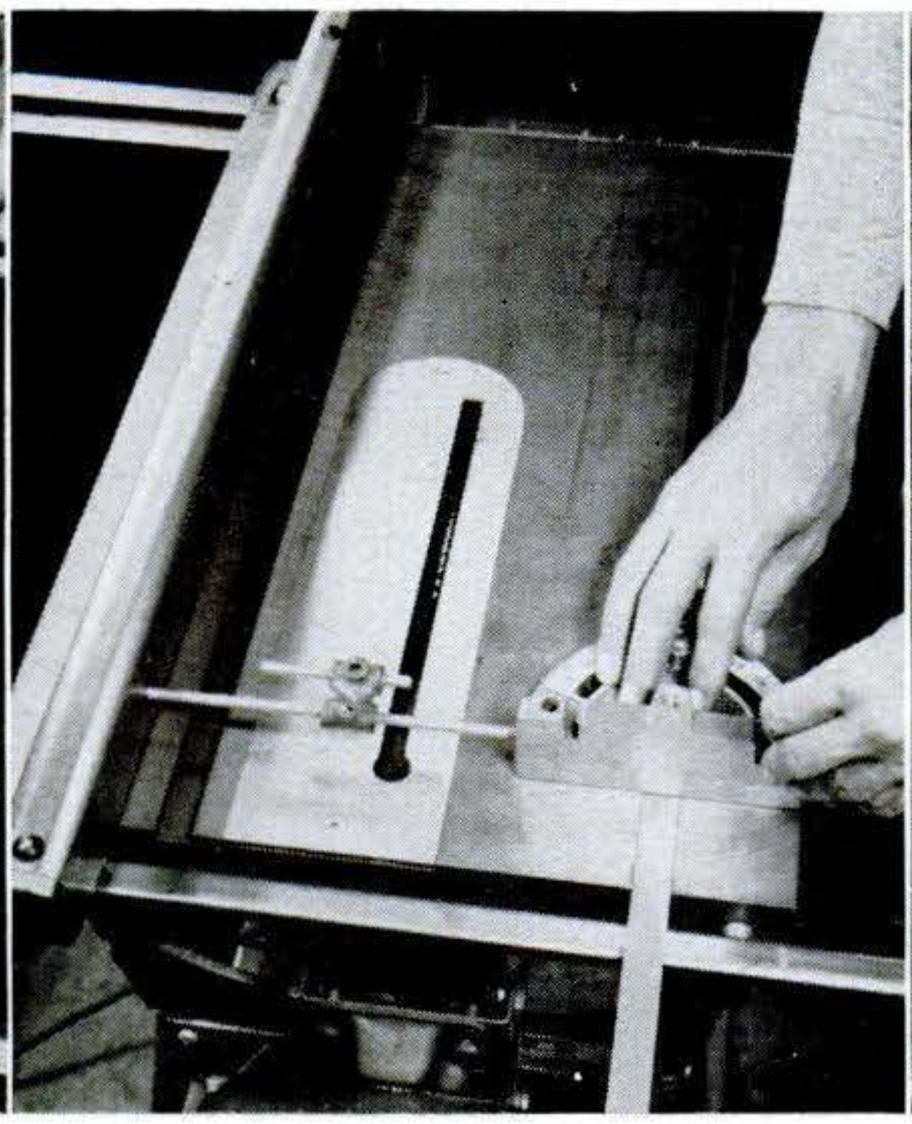
USE THE CHECK BLOCK for these checks, too. First raise the blade to its full height and, keeping the block against the miter-gauge head, bring the 90-deg. end against the blade to check the 0 position on the scale. If blade has set, hold block between its teeth. Check the blade's 45-deg. position in same way. If arbor tilt has auto-stops, set these now; if not, adjust the tilt scale or scribe exact locations on the tilt scale for the 0- and 45-deg. settings.

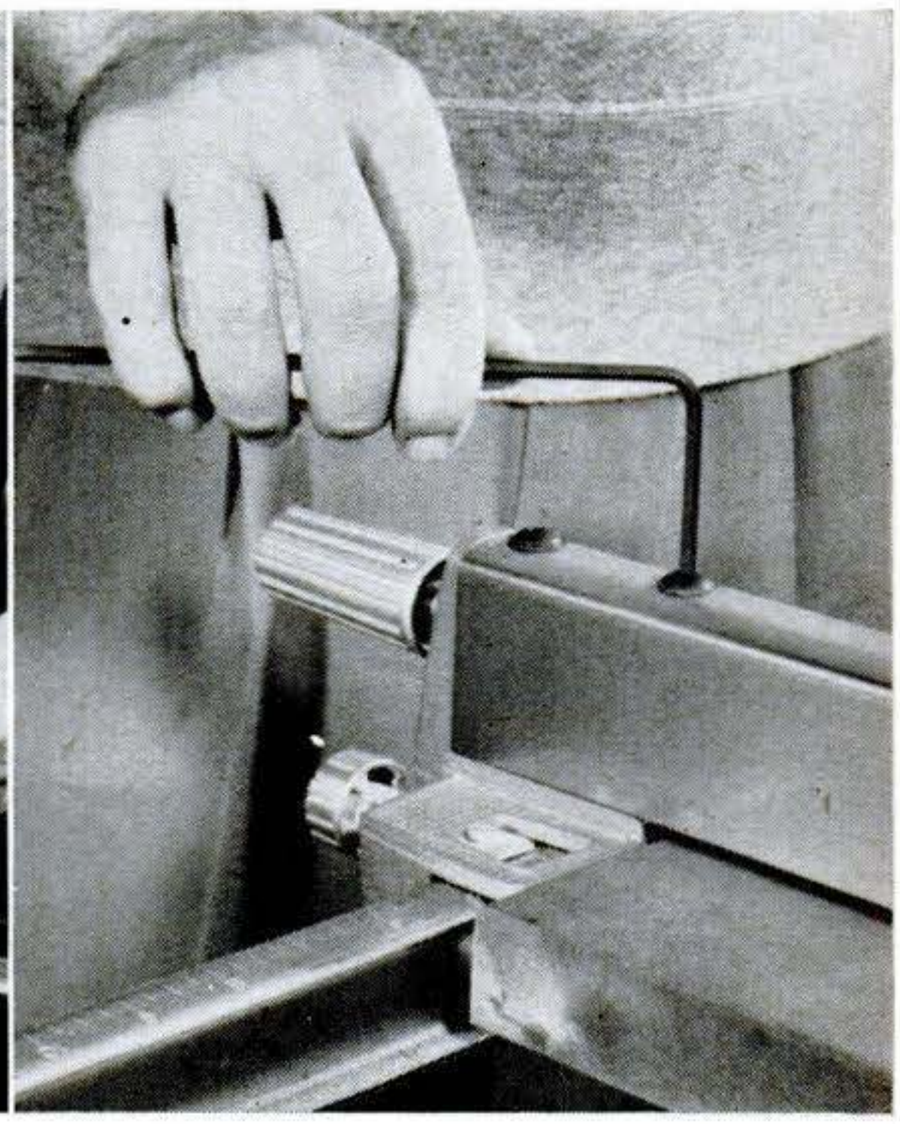
the miter gauge, in its normal position, is square to the blade and slots. That's a simple one. Put one arm of the square against the slot, loosen the lock knob on the gauge and bring the head of the gauge flush against the other arm of the square. Then tighten up the lock knob."

After this check, Johnny made a cut and then eagerly put a square across it. "Now, that's a square cut!" he said.

"And the kind you always will get if you remember the alignment checks. So







Is the rip fence parallel to the table slots?

STOP RODS can be used as shown here to make this check. Lock in position to the miter gauge so the end of the rod barely touches the fence. Then move the gauge to the back of the table. There, too, the end of the rod should just barely touch the fence. If it binds or doesn't touch at all, the fence needs adjusting. Do this by loosening the fasteners and swinging until it's in a parallel position. The fence is sometimes offset slightly at the rear, away from the blade.

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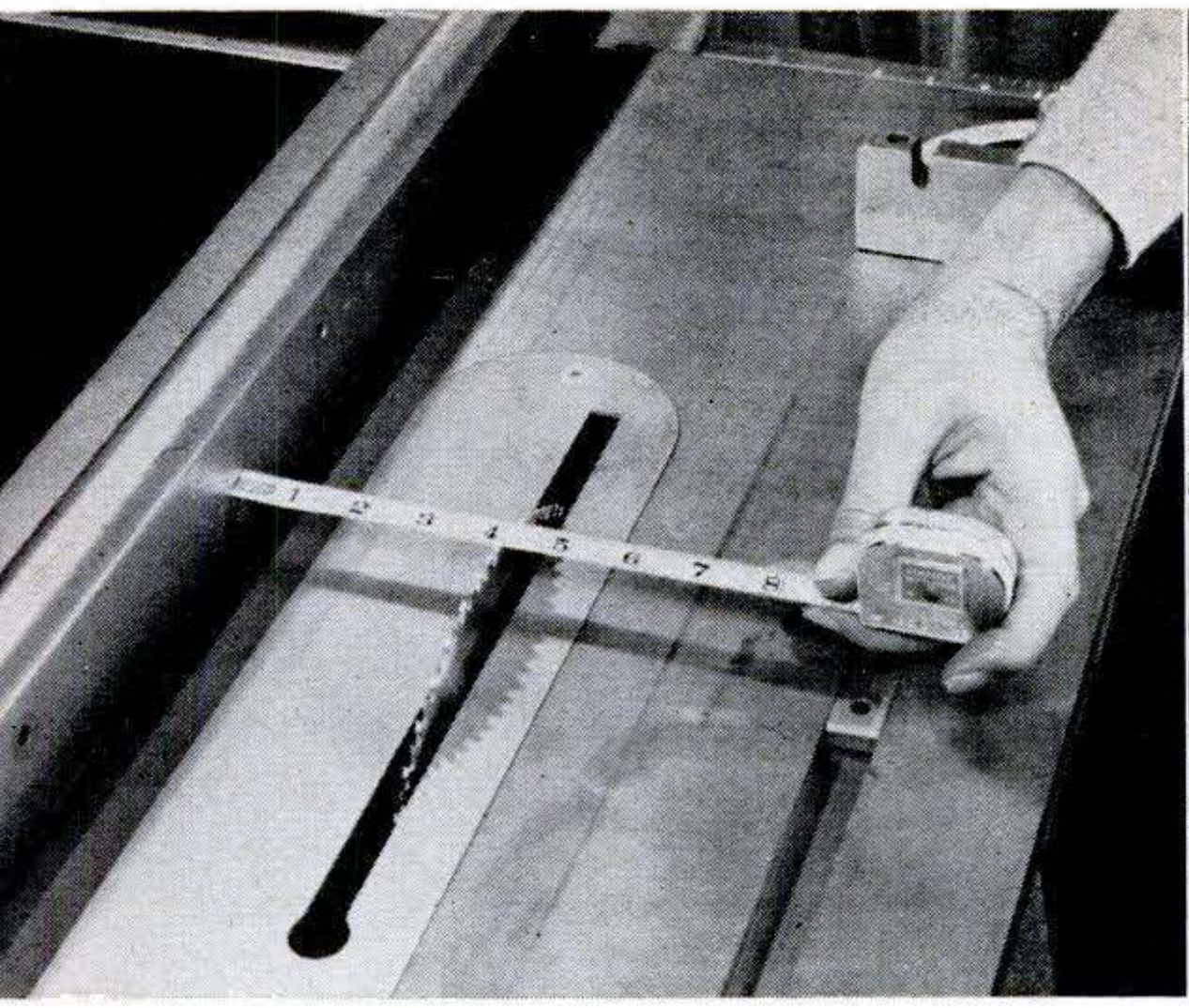

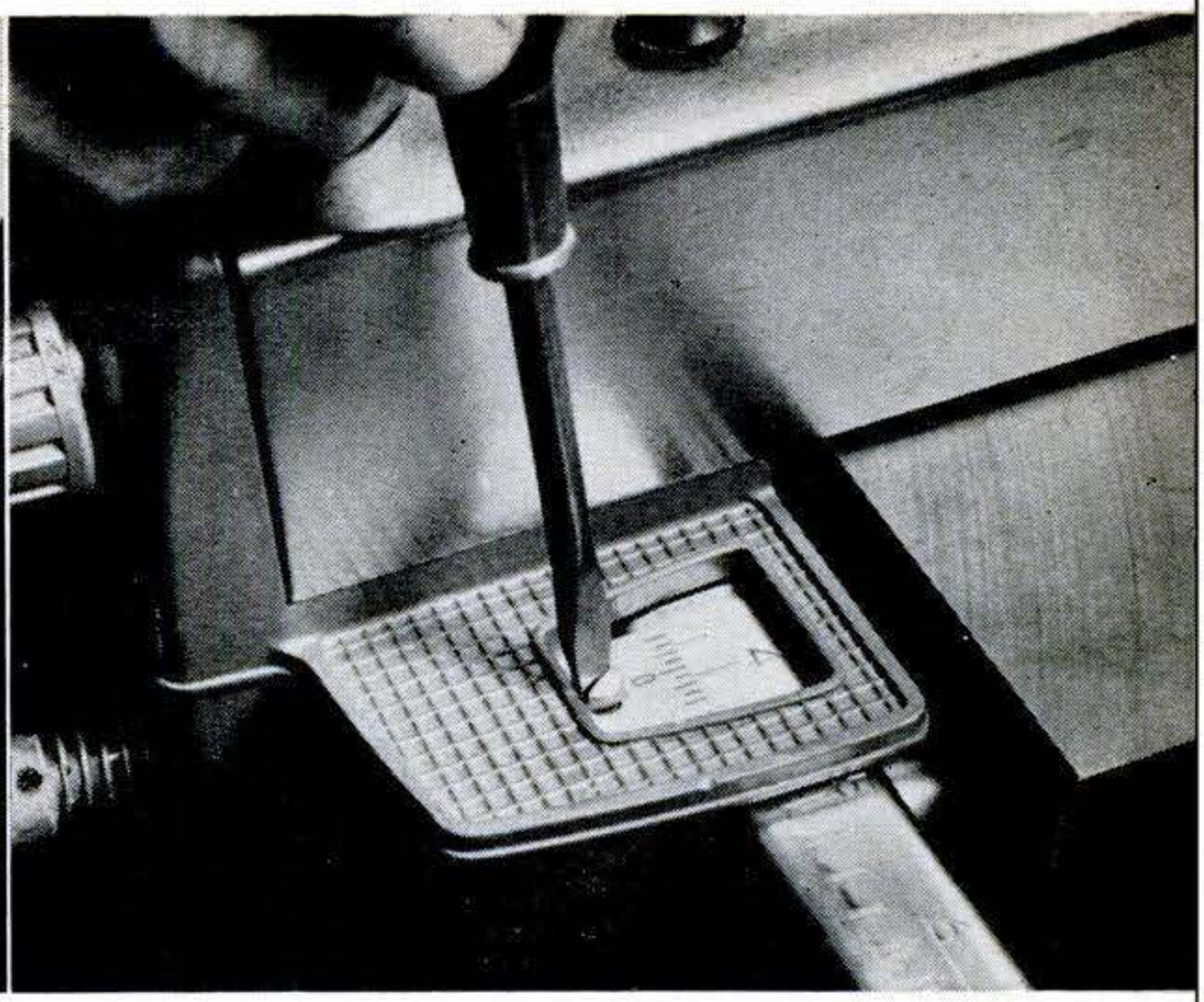

Is width-of-cut scale correct?

CHECK IT, if the saw has such a scale, by locking the fence exactly on some arbitrary measurement, in this case 4". Then set the width-of-cut pointer exactly on the 4" mark, as at right. Now use the pointer to set the rip fence for 2", 6" and 8" rip cuts. Check cuts with scale. If not exactly right, use the scale for approximate settings only and make the final critical adjustments by actually taking the measurement from the saw blade to the fence.

long as the blade is parallel to the slots and the miter gauge, in its normal setting, is square to the blade, you can't help getting perfect 90-degree cuts."

"What's next?" Johnny asked.

"Be sure the miter gauge is accurate at left- and right-hand 45-degree settings. Many workers do this by trial and error but I prefer taking a few minutes to make a precise check block.

"***Establish the checking angle*** by marking it with a square, cutting outside the line and then sanding exactly to the line. The sides of the block must be perfectly parallel and the corners opposite the 45-degree cut must be perfect 90-degree angles.

"Once the angle is established, set it flush against the blade and clamp it to the table. Then slide up your miter gauge and swing the head flush against the block. Turn the block over and make a similar check on the other 45-degree setting. This miter gauge has auto-stops, so set them now and you'll know that henceforth 45-degree miter cuts will be just that. Folks who don't have auto-stops should scribe marks on the gauge protector so they will know exactly where to position the head."

Johnny was so attentive now that he just looked and listened.

"The other end of your check block," Jim continued, "is used to check the blade angle at '0'. Hold it firmly against the miter gauge and flush against the blade, which should be at its maximum height setting. If the blade isn't snug against the block from the table surface to the gullets, then tilt it relative to the correction needed. When it's right, lock it in place and set the auto-stop. Then adjust your tilt scale to exactly '0'."

"That takes care of the '0' setting," Johnny said.

"Sure, and while we're at it, we may as well use the block to check the blade at 45 degrees. Do it just as you did at '0' except that you tilt the blade to the angle. On a tilting-table saw you could use the same kind of check block."

"Is that it?" Johnny asked.

Jim grinned. "You're forgetting the rip fence. After all, cutting isn't all miter-gauge work. The rip fence should be parallel to the table slots, which puts it parallel to the blade. Now rip work will pass between blade and fence without binding, and with minimum kickback.

"I use stop rods for this check. In

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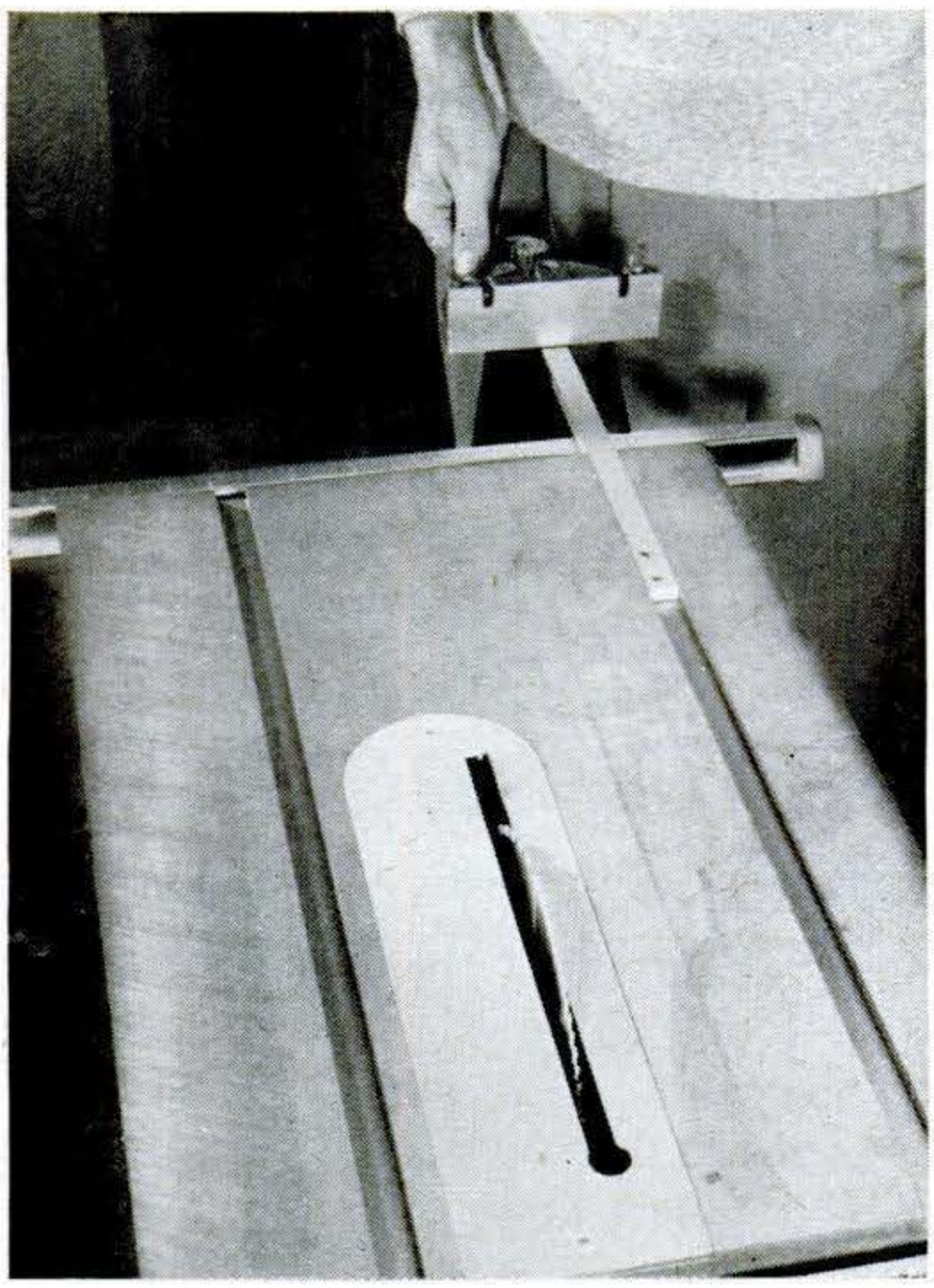
practice it's just a mechanical method of measuring distance from rip fence to slot at both front and rear of the table. If the distance is equal in both places, then you know the fence is parallel."

"What about this business of offsetting the fence slightly at the rear?" Johnny asked.

What's Wrong Here?

While building a set of kitchen cabinets, Johnny Jones found it necessary to cut a 2" strip off one edge of an 18"-by-18" piece of ¾" plywood. An accurate cut was desired for a nice fit. In the picture below, you see his new table saw just a moment before he made the cut. Is this the way you'd do it?



Here's What:

A lot of us would commonly make the cut this way. The skilled hands would probably get it square. But others would get the desired cut only through luck. For accurate cuts this wide it's much better to use the rip fence, not the miter gauge.

The reason: The difference between the width of the miter-gauge bar and the table slot—necessary so the bar will slide—can cause serious inaccuracy when the miter gauge is drawn off the table to the extent shown.

"Many people do this to reduce binding. On plywood, it also tends to cut down splintering and feathering. The trouble is that many beginners offset the fence so much that it amounts to misalignment. The offset, if used, should not be greater than $\frac{1}{32}''$, and of course should be away from the blade."

"That's it now, isn't it?"

"As far as alignment is concerned, yes," Jim said. "But your saw has a width-of-cut scale on the front-fence rail. If you're going to use it for rip cuts, you should check that, too. That's just a matter of locking the rip fence in an arbitrary position and then measuring exactly to the saw blade. If the blade teeth are set, be sure to measure from a tooth which is set toward the fence. To be absolutely sure, make a rip cut and measure it. Then set your width-of-cut pointer exactly on that dimension."

"Then you can establish any rip-cut width by using the pointer, is that it?"

"We like to think so," Jim said, "but it's not always the case. After you've made that first check, make other cuts by setting the fence with the pointer—then check the cuts by measuring. If you find the scale is really accurate, then you can use it. But don't be disappointed if it isn't. After all, it's just a stamping, you know.

"I usually use mine for an approximate setting, then make final critical adjustments by actually measuring from blade to fence. Another thing to remember on that scale is that a change of blade will upset it. Some blades are thicker, a blade with set teeth cuts wider than a hollow-ground blade, some blades have more set than others. All these factors increase or reduce actual distance between blade and fence, and that throws your scale off. Of course you could readjust it every time you mount a different blade."

"How often should these accuracy checks be made?" Johnny asked.

"Depends greatly on the amount of work you do. If you use the saw a few nights a week and every weekend, you ought to do it about once a month." END

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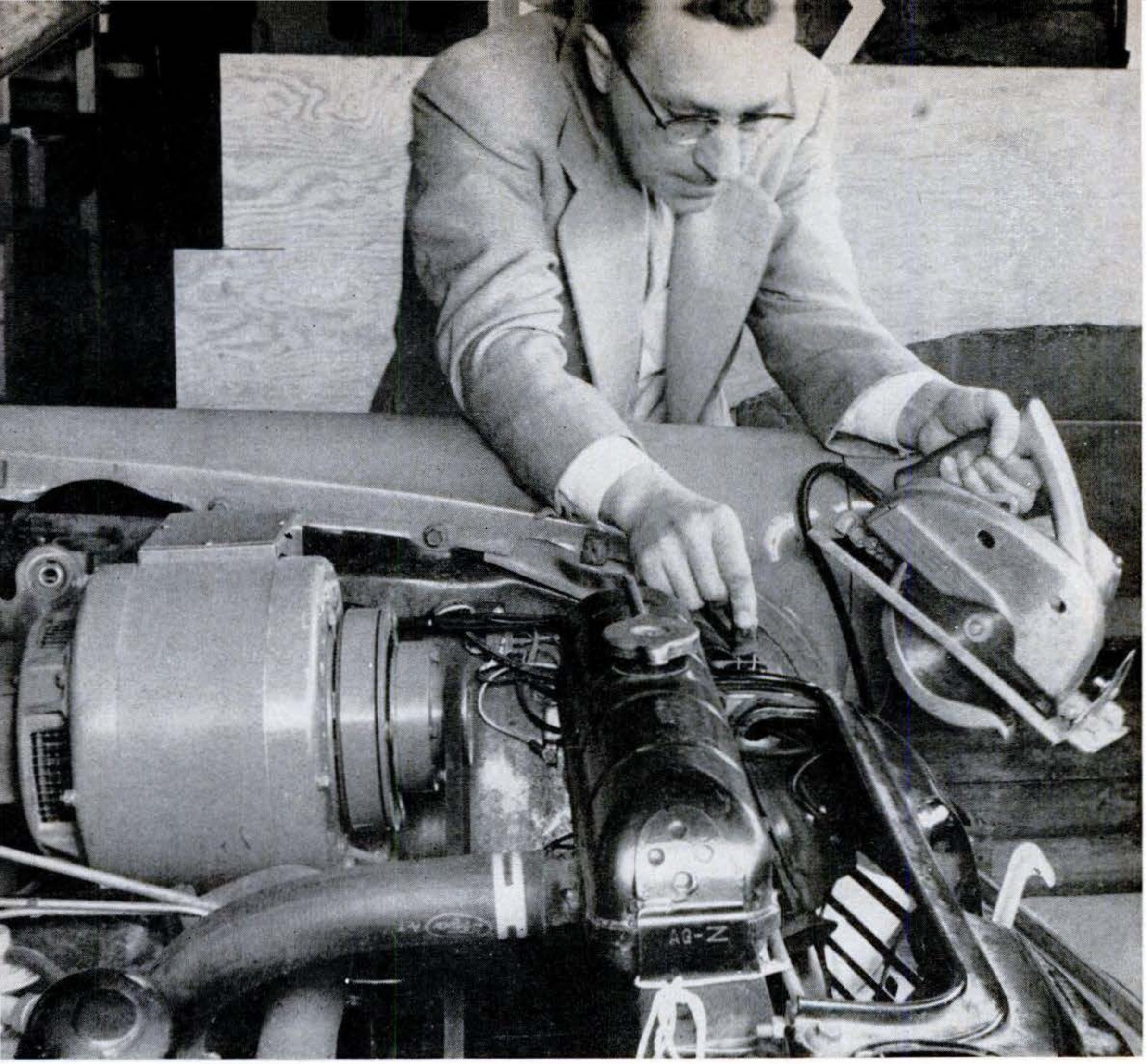

Now you can have 115 Volts Under the Hood

Install-it-yourself generator kit turns any car into an emergency or off-line AC power plant.

By E. F. Lindsley

YOU can now buy a beefy emergency home lighting plant in which your automobile supplies two-thirds of the equipment, and passes the saving on to you. As a dividend, you get a mobile source of 115-230-volt AC current for outdoor chores that require such electric tools and equipment as saws, drills, paint sprayers, mowers, cement mixers and pumps. And if you own a cottage far from a high line, you can light it up like a Christmas tree.

The power package that makes this possible consists of a 3,500-watt generator (it will deliver up to 6,000 watts for limited periods), a bracket to mount it on your car's engine, pulleys and a belt to couple it to the engine's fan drive, a control panel and a hand throttle.

All of the other components—engine,

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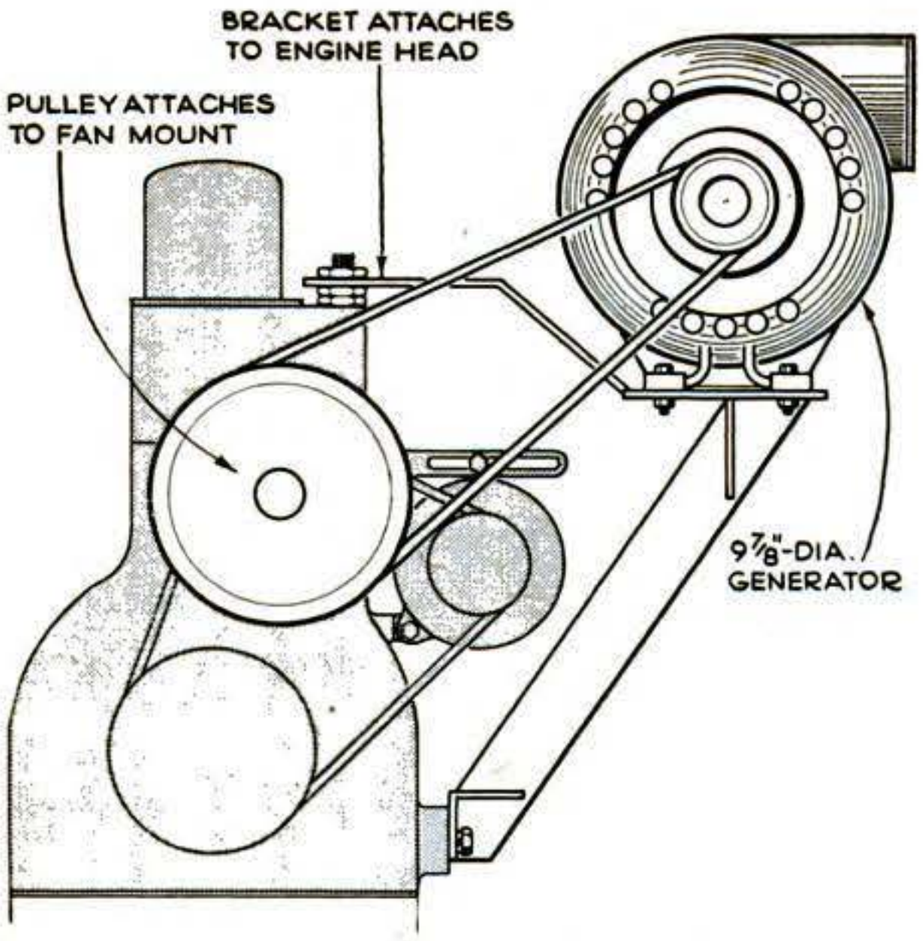
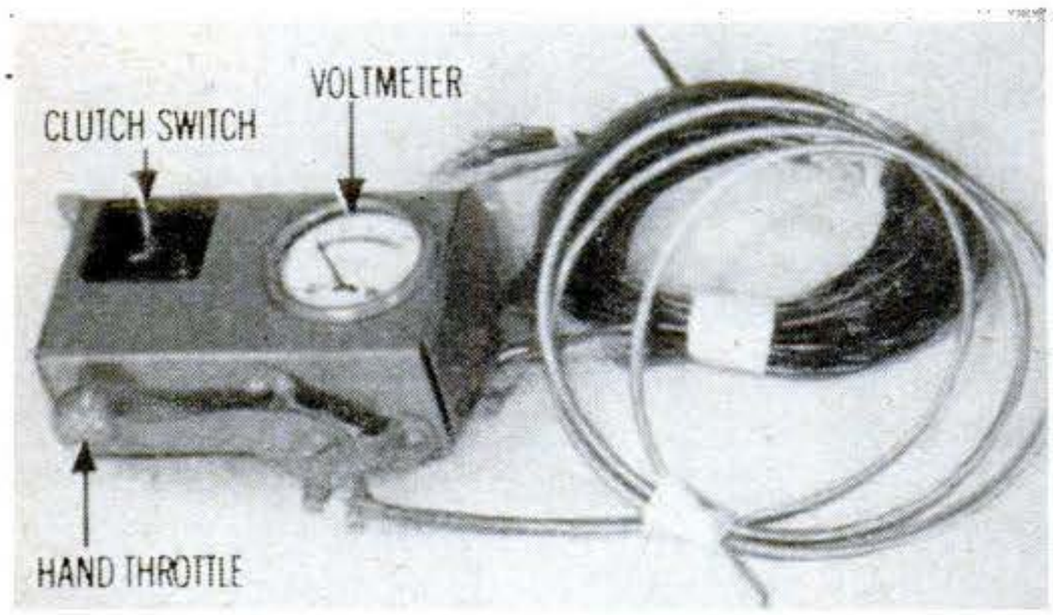




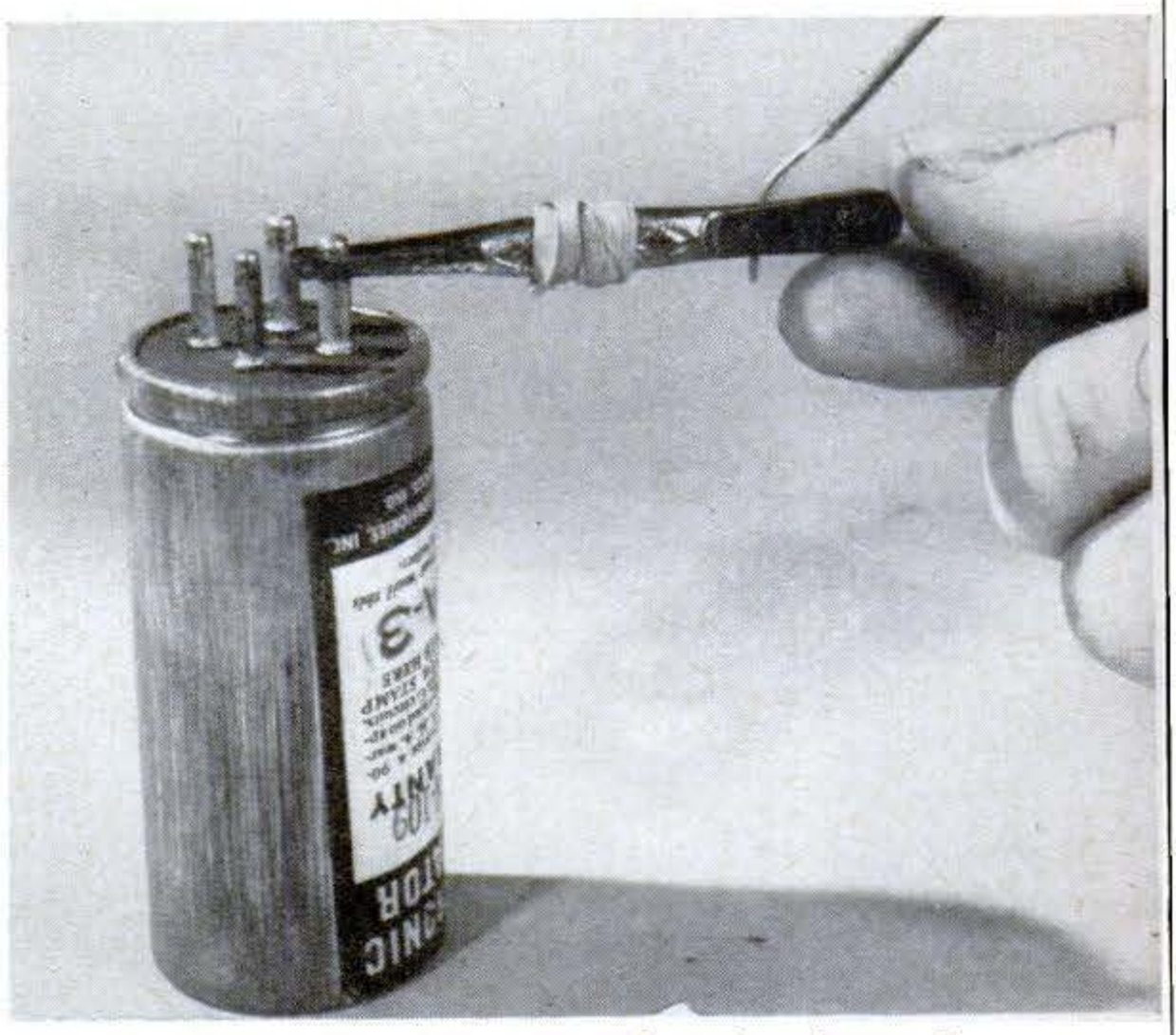
GENERATOR COMPONENTS under the hood are operated by a control box and hand throttle under the dash. A relay in the box increases field current to handle heavy starting loads.

cooling system, starting battery and exciter (automobile generator)—are already under your car's hood.

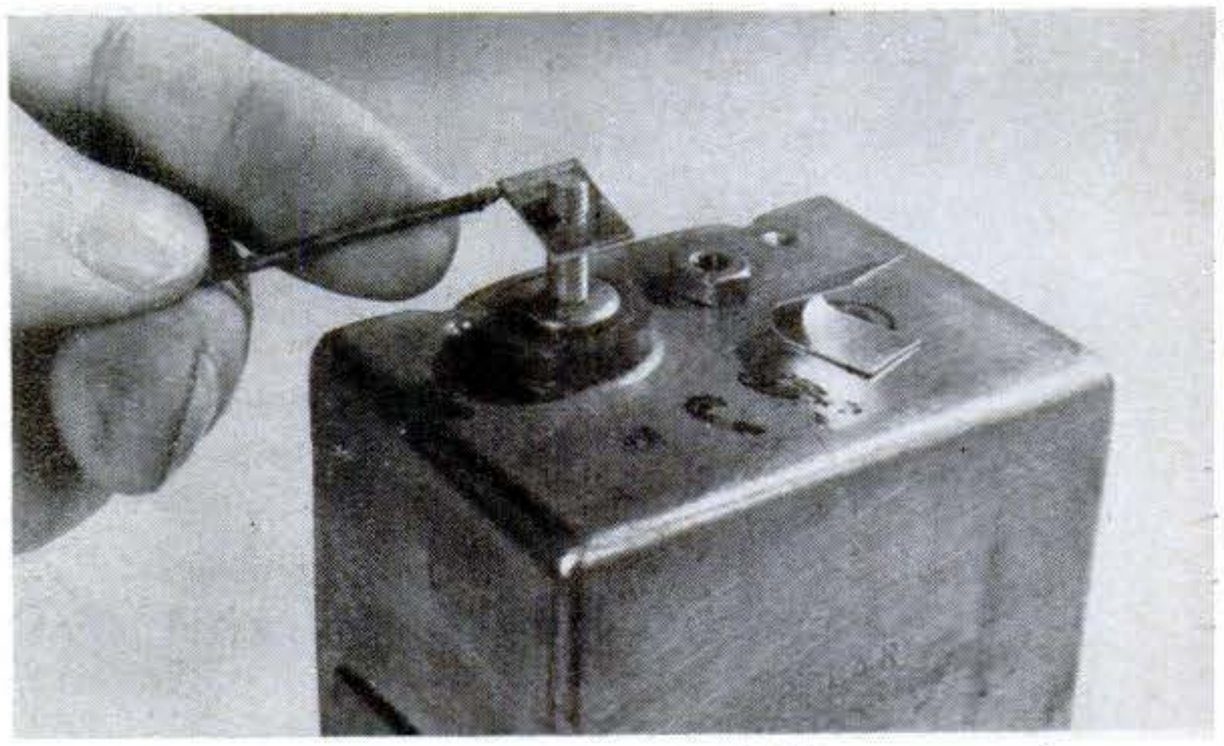
When you're driving, the AC generator's pulley wheel idles on the armature shaft. But when you want electric power, you flick a switch on the control panel under the dash, engaging an electric clutch. Then you rev up the engine until a voltmeter on the panel reads "115," plug into either or both of the output receptacles on the generator—and that's it. To use the current for emergency home power, you simply pull the main house switch and run an extension cord from the generator to a receptacle.

Bob Kern, the young Wisconsin engineer who developed this power package, points out that its high wattage output makes it useful for many farm and light industrial chores, as well as home use. His kit is manufactured under the trade name "GenerAC," by Electric Controls, Inc., Wales, Wis. Price: $275. END

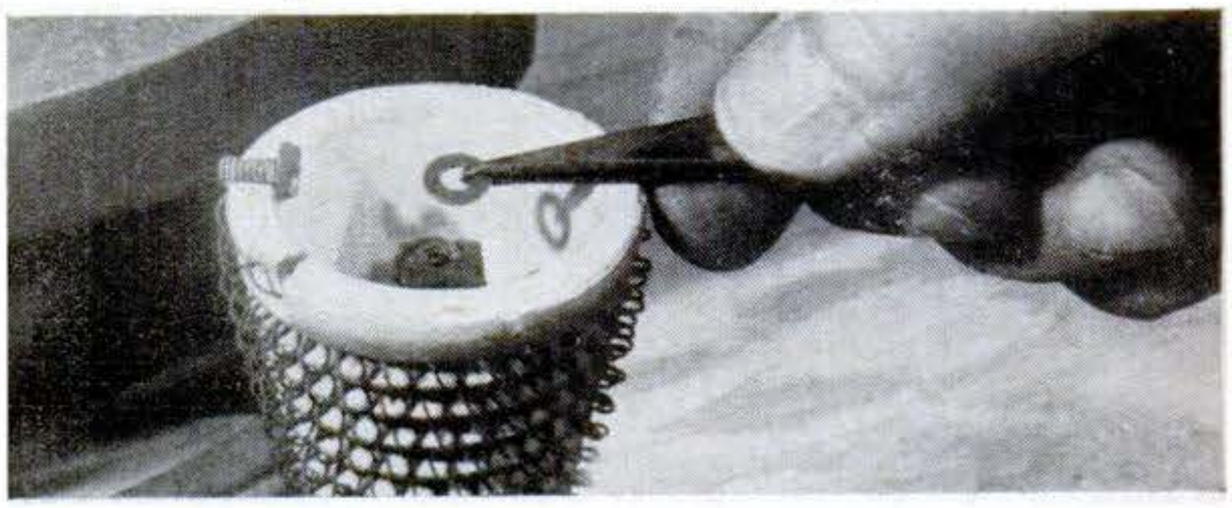
7 Electrical



1 NEED AN ALLIGATOR CLIP for circuit testing at low voltages? Wedge the bare end of a wire in the fork of a pair of tweezers and wrap a rubber band around them for tension.



4 FOR A NEAT TERMINAL LUG, fold a strip of brass or copper over the bared end of the wire. Tin wire and inner lug face first. Then apply heat for a sweat-soldered bond. Drill a hole for the post and trim the lug edges.



5 PREVENT ARCING and radio interference, which may result if the ends of the wire coil in a bowl-type heater, often held by a flathead screw, are not tightly connected. A washer above the looped wire end will give the screw a better grip for a snug connection.

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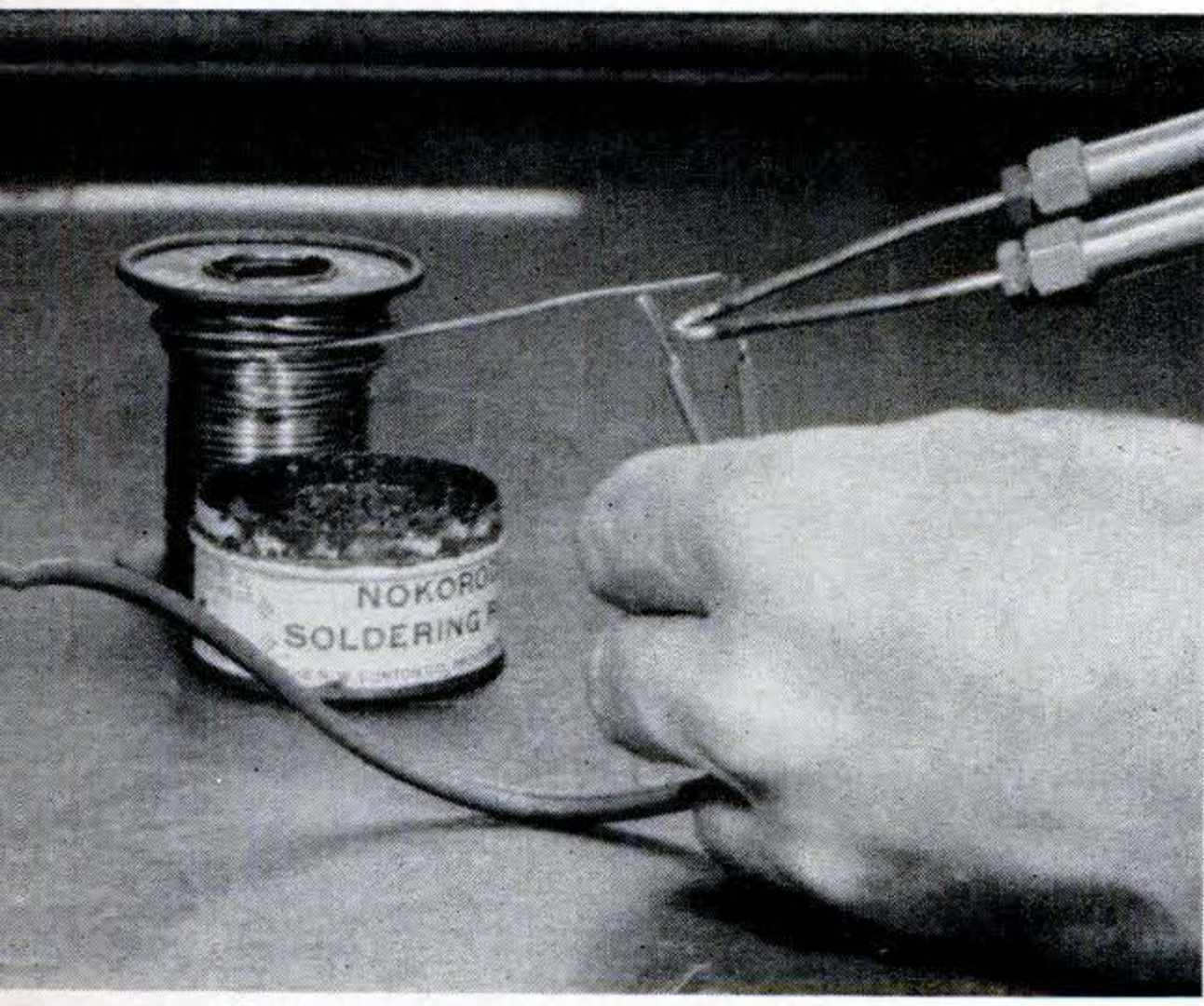
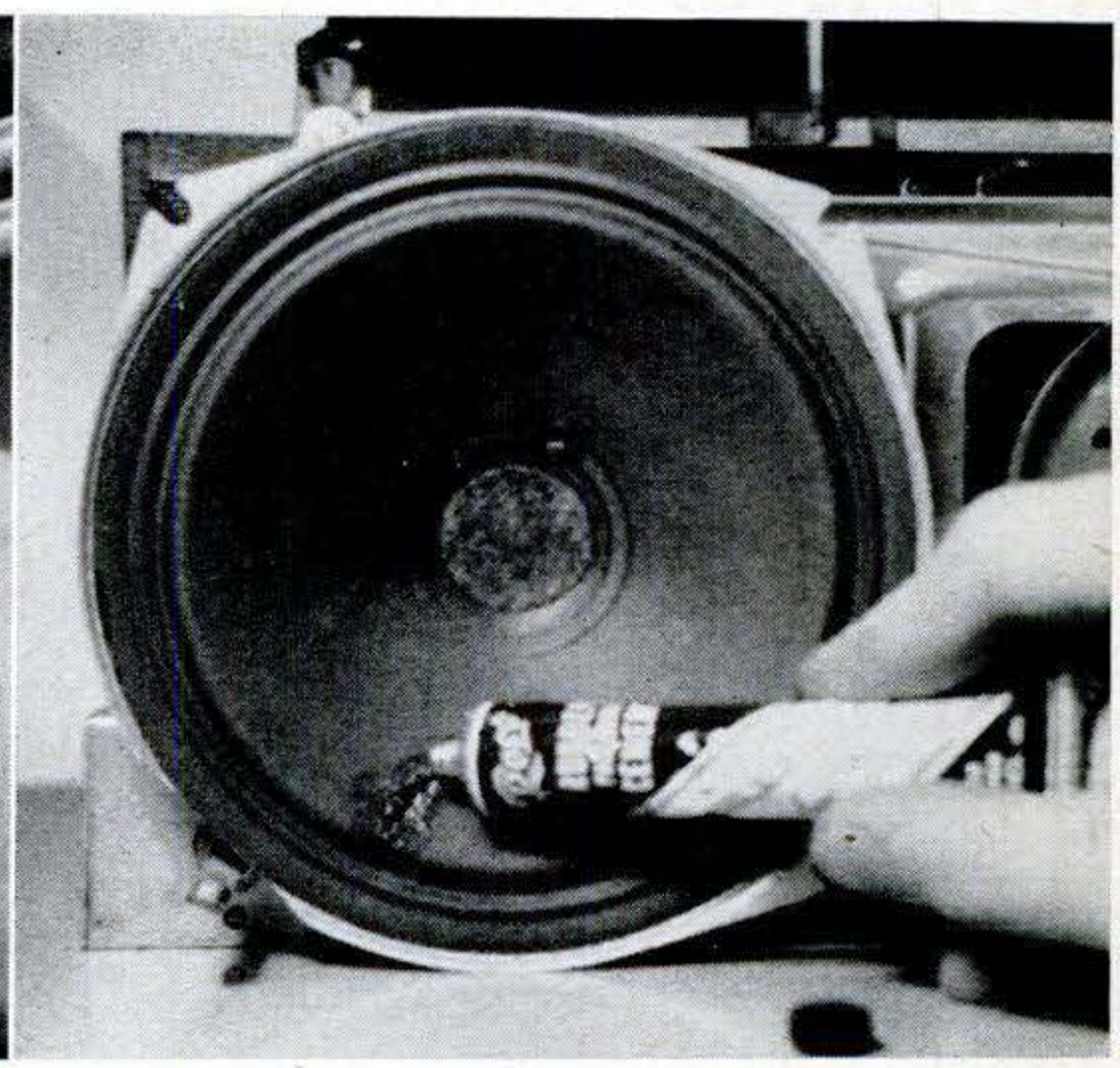
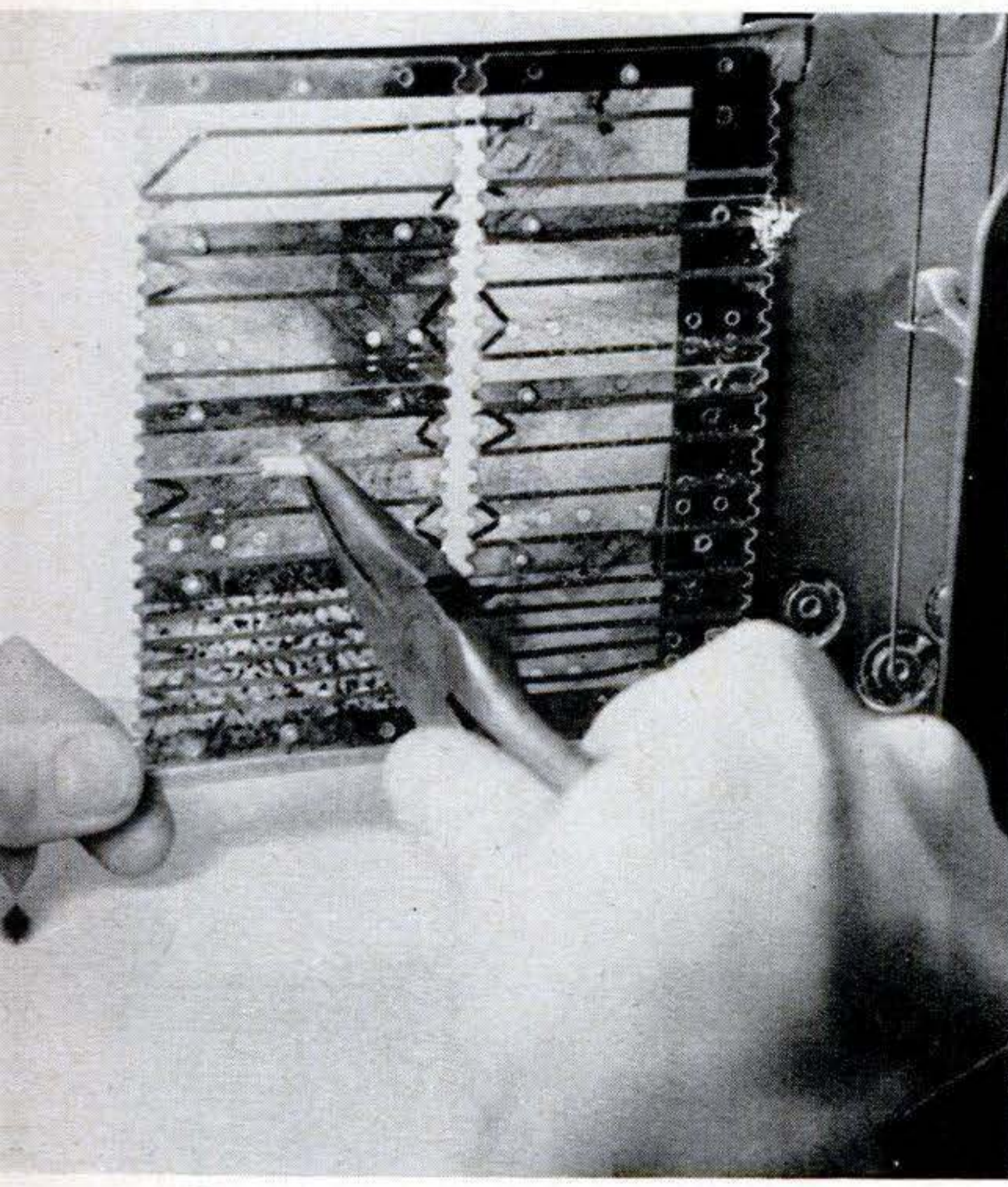
Tips for the Handyman



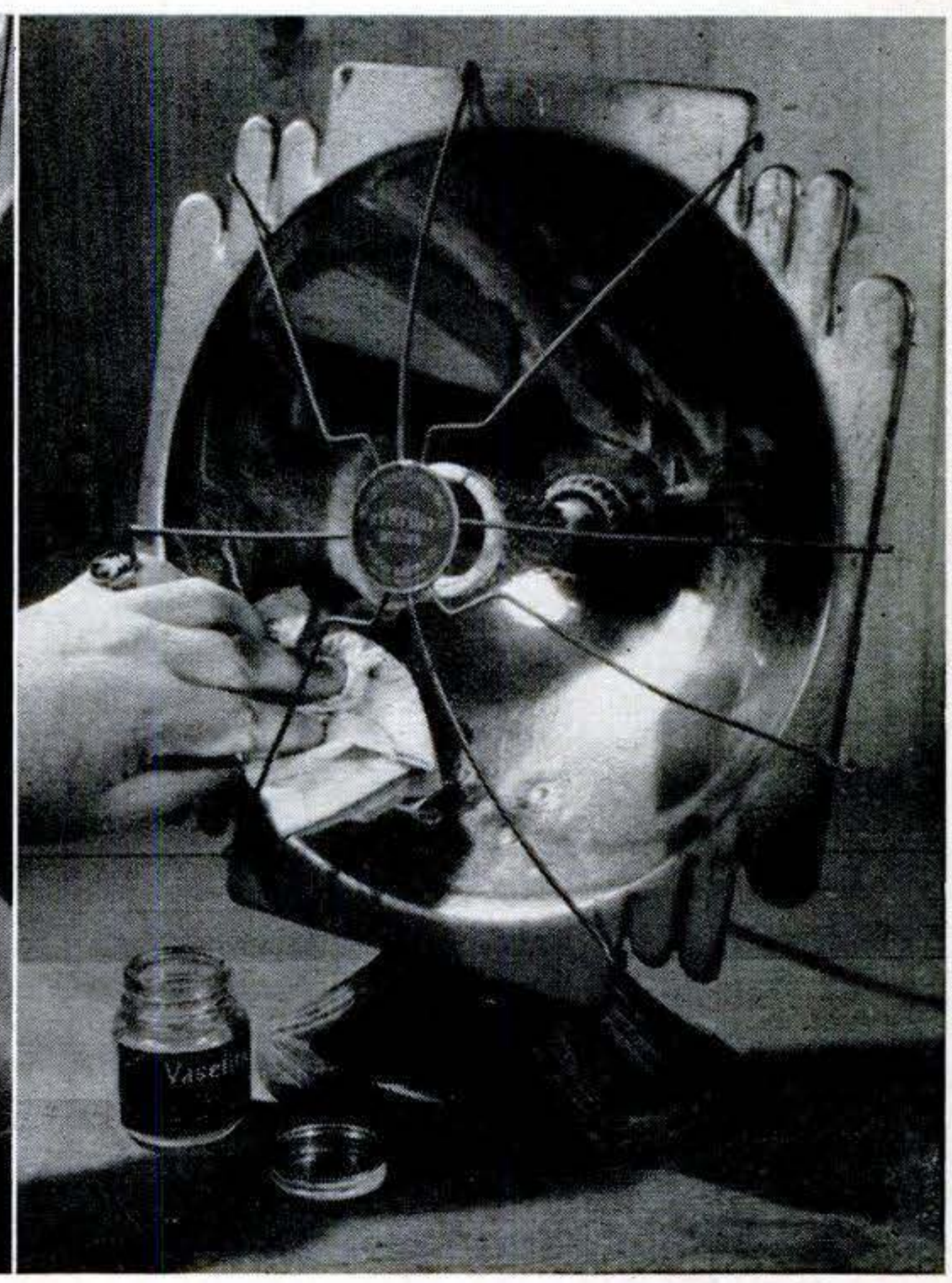
2 TINNING THE BARED ENDS of lamp-cord wires with solder binds the copper strands together, insuring neat connections. And there will be no loose strands to cause shorts.



3 TO MEND A SPEAKER CONE, use rubber cement instead of hard-drying cement, which may contract and cause tone distortion. Rubber cement remains flexible even when it's dry.



6 A BURNED-OUT ELEMENT in a toaster can be repaired with a splice made from 1/8" copper tubing. Cut off a 1/2" length of the tubing, slip the parted ends of the element together inside the sleeve, and then flatten the sleeve against the ends of the element with pliers.



7 PROTECT AN ELECTRIC-HEATER BOWL from possible rust-through during summer storage by wiping a thin film of vaseline or heavy lubricating oil on the nickel or chrome plating. It will take but a minute or two next fall to remove the protective coating before use.

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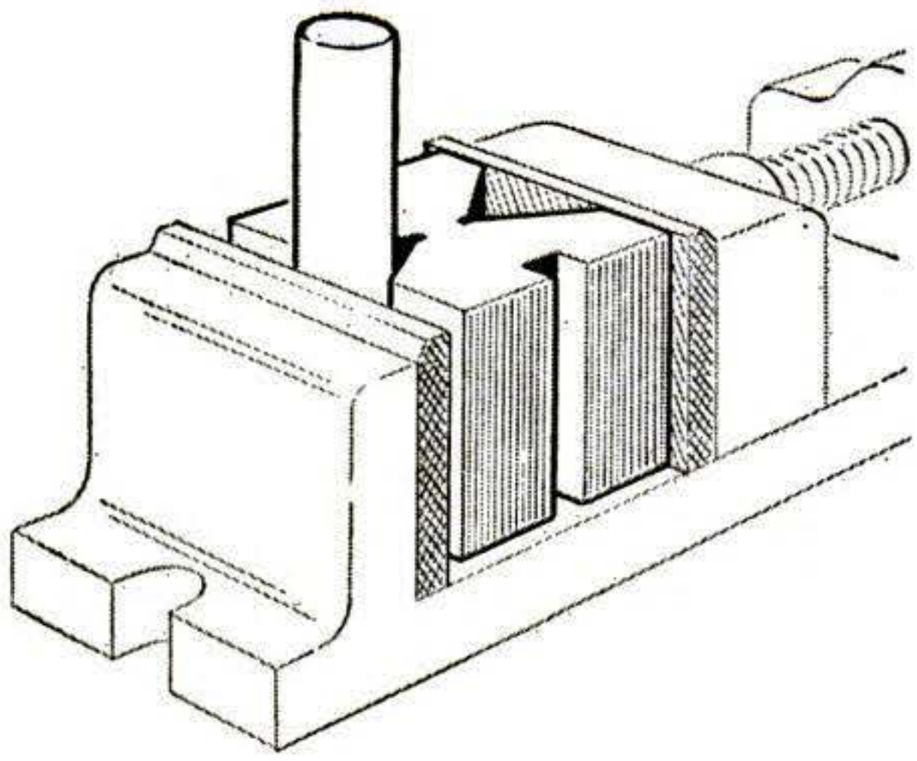
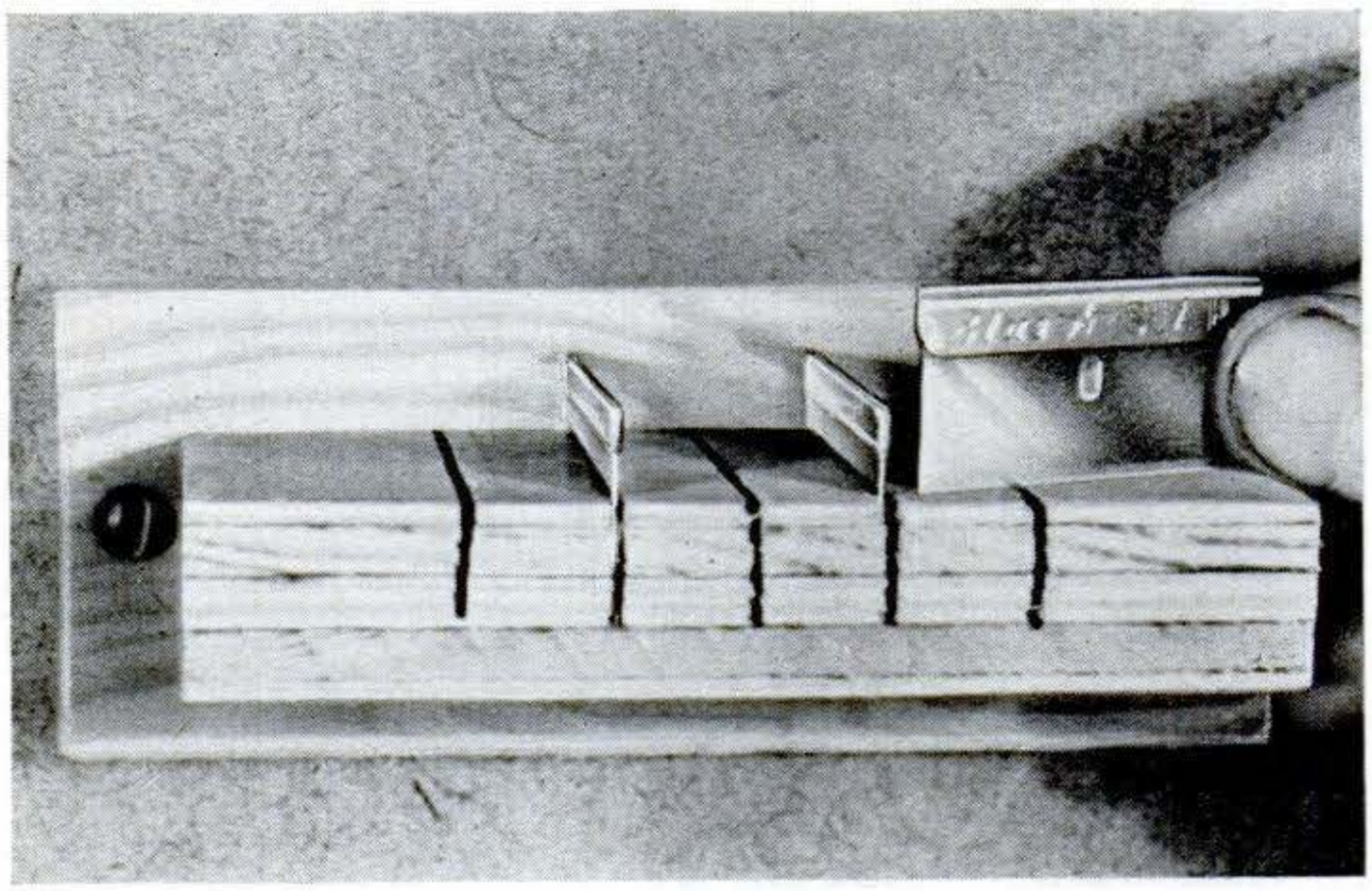
PS Shop Notebook

To Grip Round Stock

To hold round stock vertically for drilling or machining its end, grip it with a V block clamped on end in a drill-press vise. The squared end of the block against the vise and its accurately ground V groove will hold the rod true against the fixed jaw of the vise.—*Frank LaSaracina, New York City.*



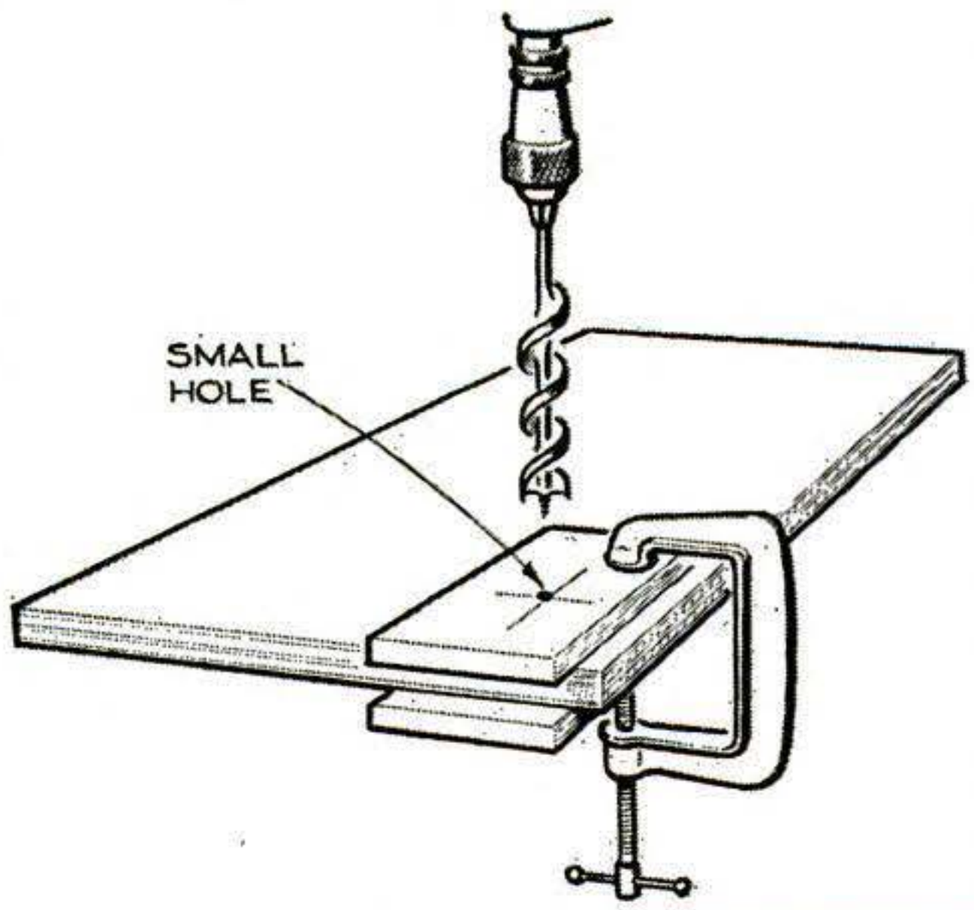


Wood Rack Protects Razor Blades

Keep razor blades handy and protect their edges by storing them in saw kerfs. Use a 2″-wide scrap of ¾″ wood and nail it to a small back board.

HAVE YOU TRIED THIS?

Drill splinter-free holes in plywood by sandwiching the work between pieces of scrap. For accuracy, drill a small pilot hole through the work on the layout center and another hole through the top piece. Line up the holes with the drill shank and clamp the three pieces of wood together. Then use the small hole to pilot the bit through the work.



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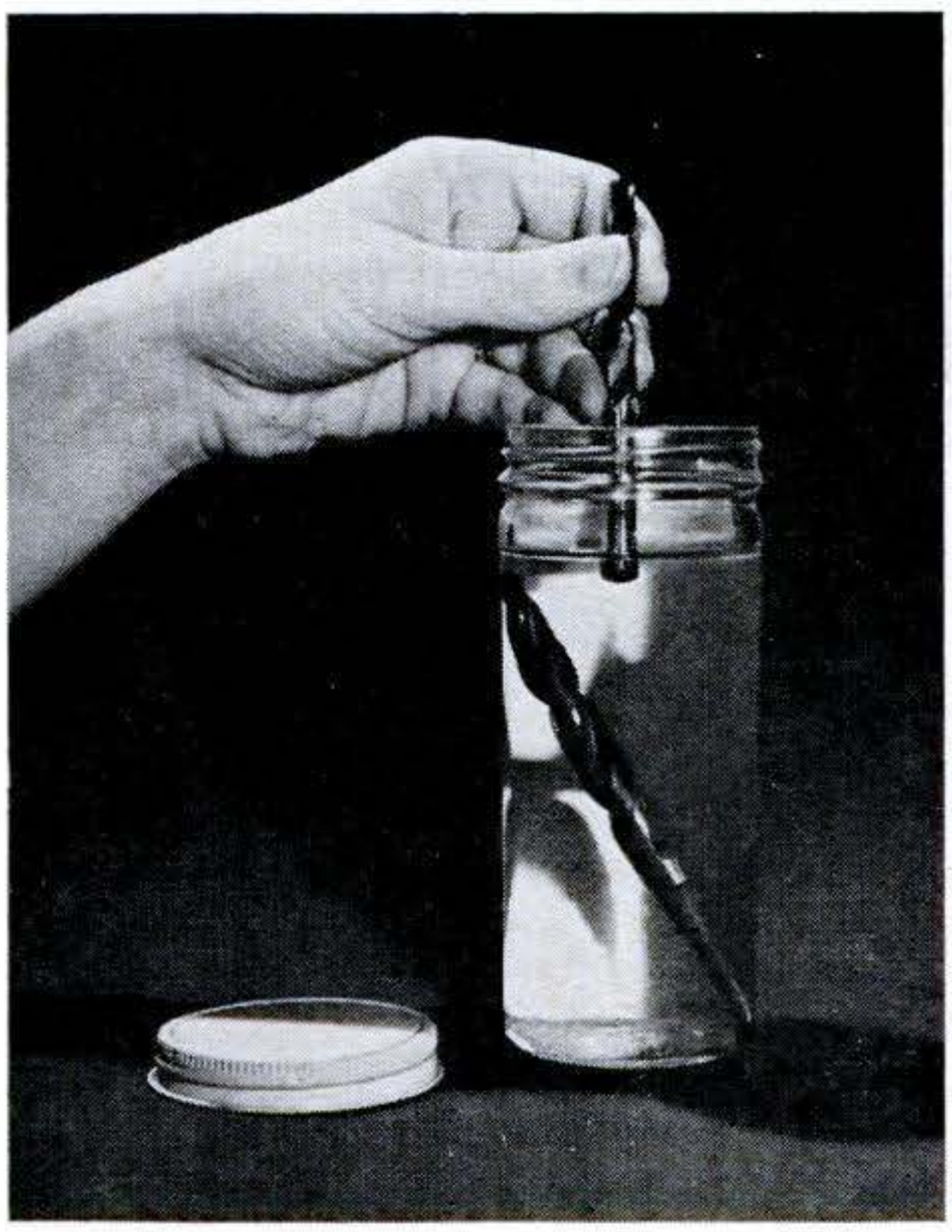
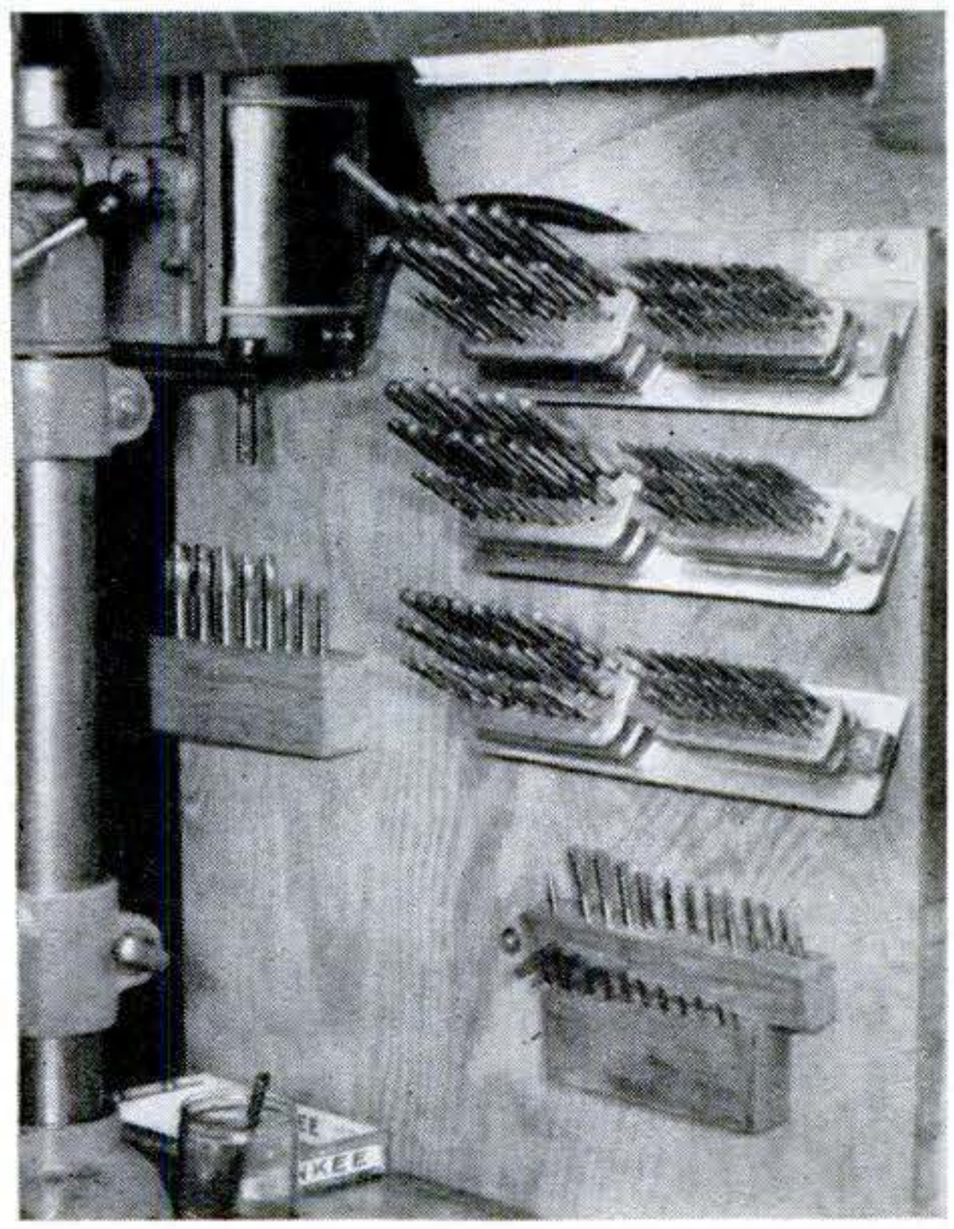
For Easy Soldering

Permanently tin the tip of a soldering-iron by heating with a torch and flowing silver solder over it. The tip will stay bright because normal soldering temperature won't spoil the coating.—*H. Josephs, Gardenville, Pa.*



Clean Drills Stay Sharp

Soak drills in a jar of lacquer thinner occasionally if you use them on wood. When the coating of wood pitch has softened, wipe the drills clean with a rag. If this coating is allowed to build up on the flutes, friction heat draws the temper out of the metal and drills dull quickly. —*Frank A. Javor, Newark, N.J.*



Keeping Drills in Order

A tool board like this mounted behind the drill press keeps drills off working space and makes it easy to replace them after use. Make the board of ⅜″ plywood. Bolt the drill sets to ⅛″ hardboard or sheet aluminum mounted on blocks or brackets at a 30° angle to the vertical.—*J. C. Magee, Schenectady, N.Y.*

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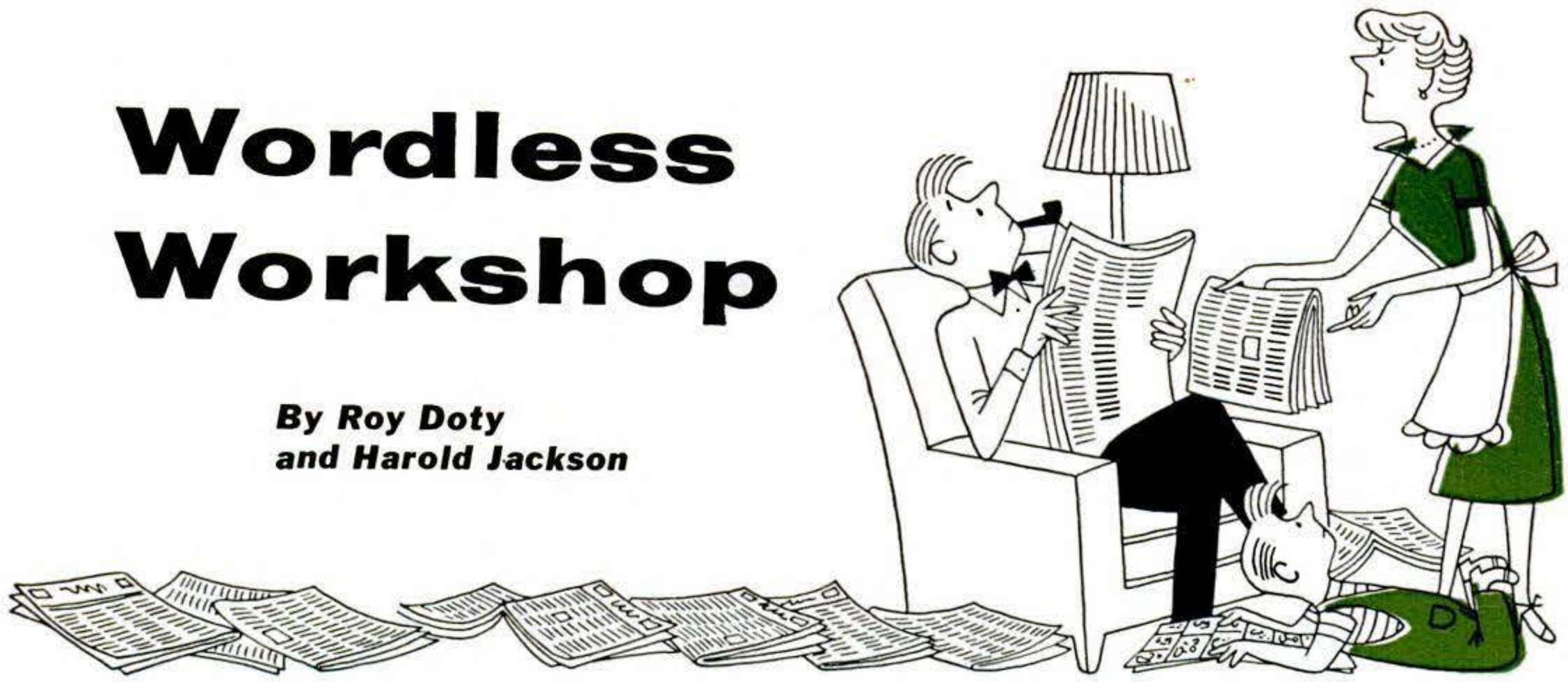
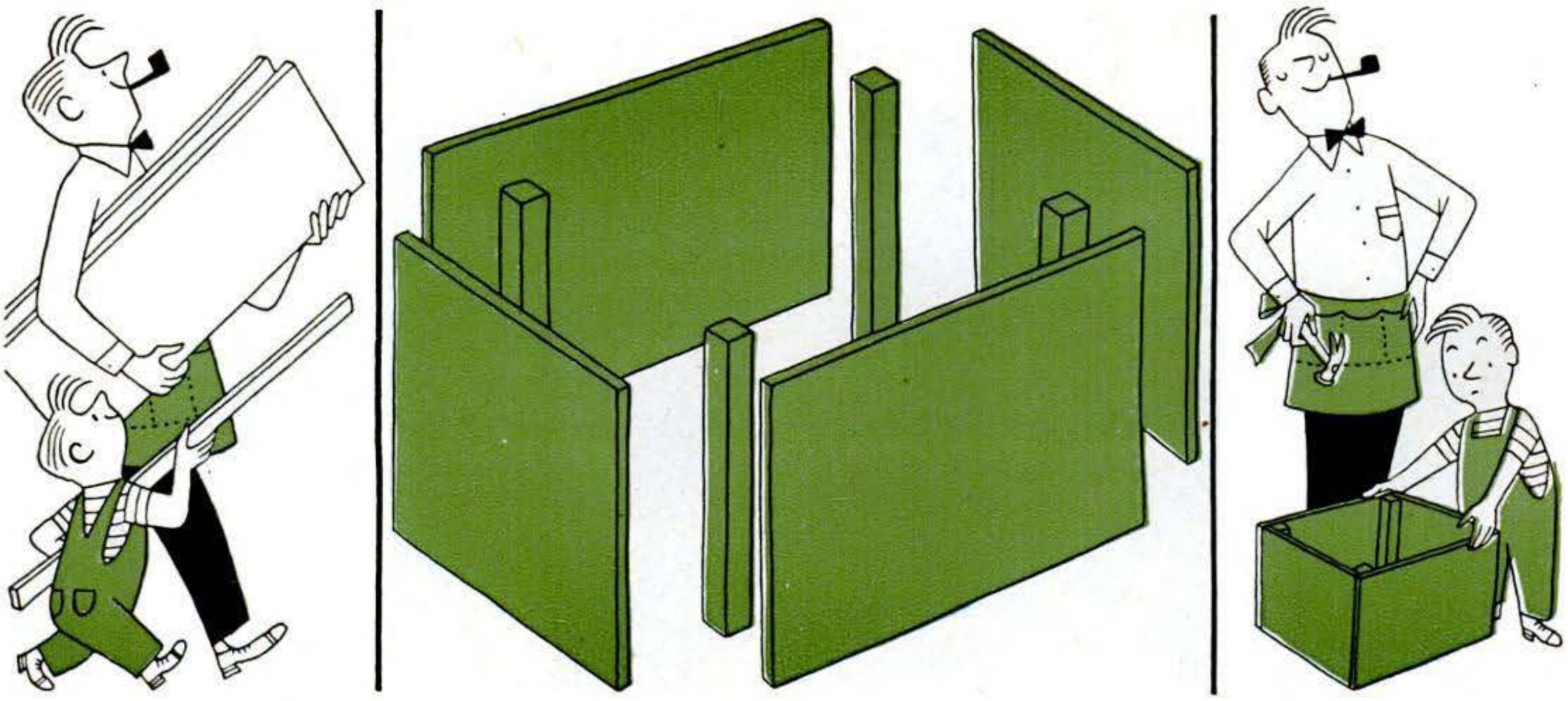
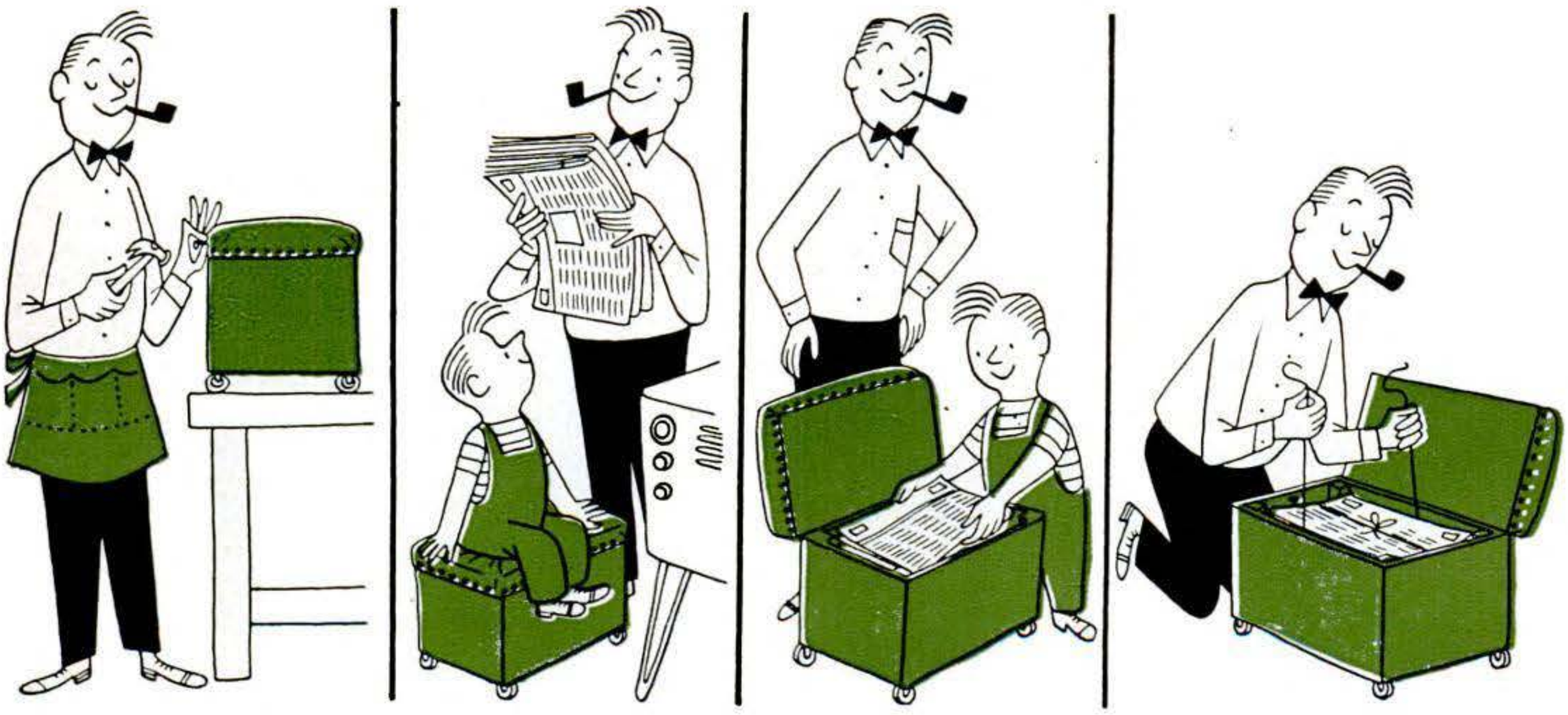
Wordless Workshop

By Roy Doty
and Harold Jackson







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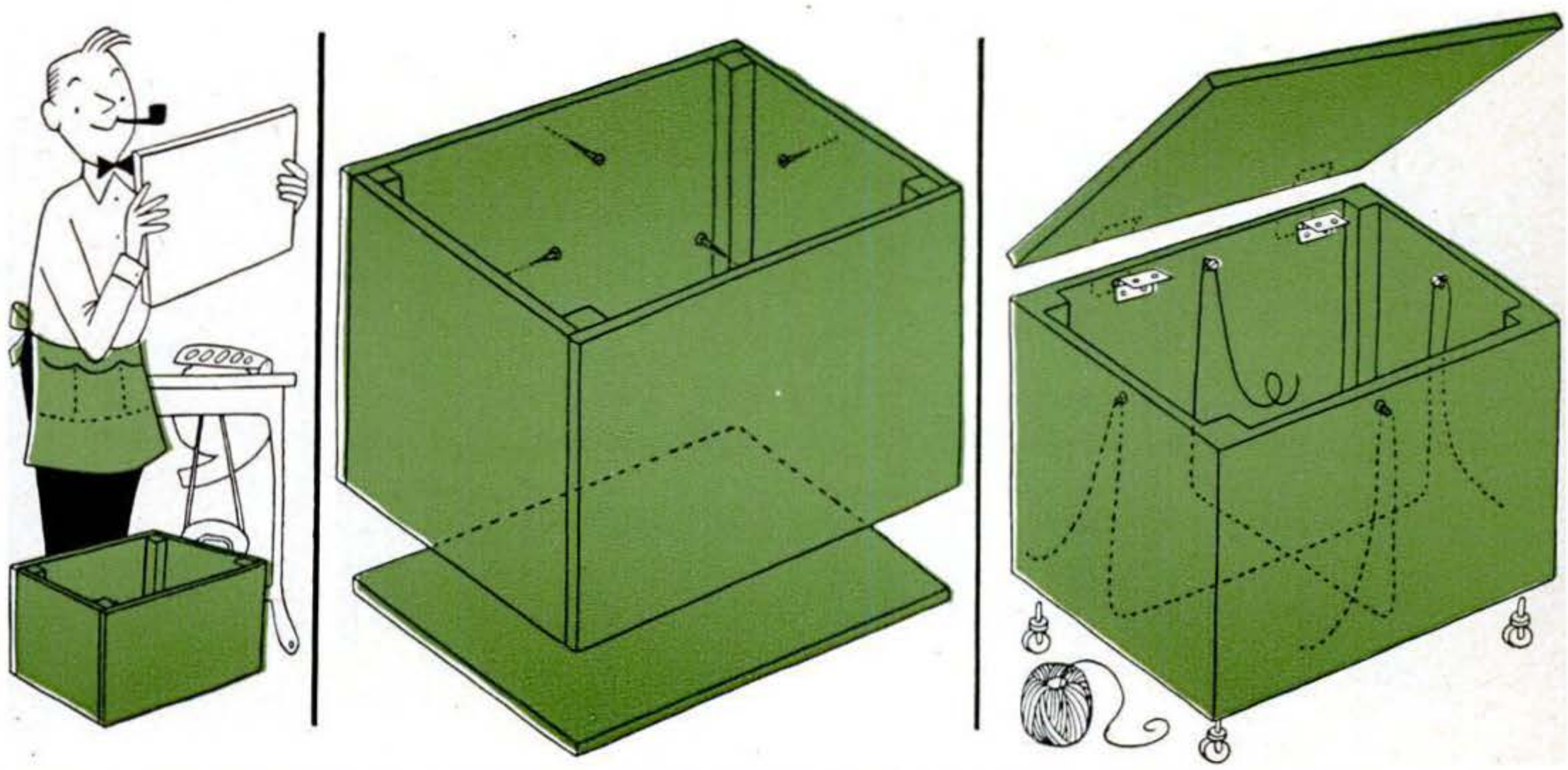

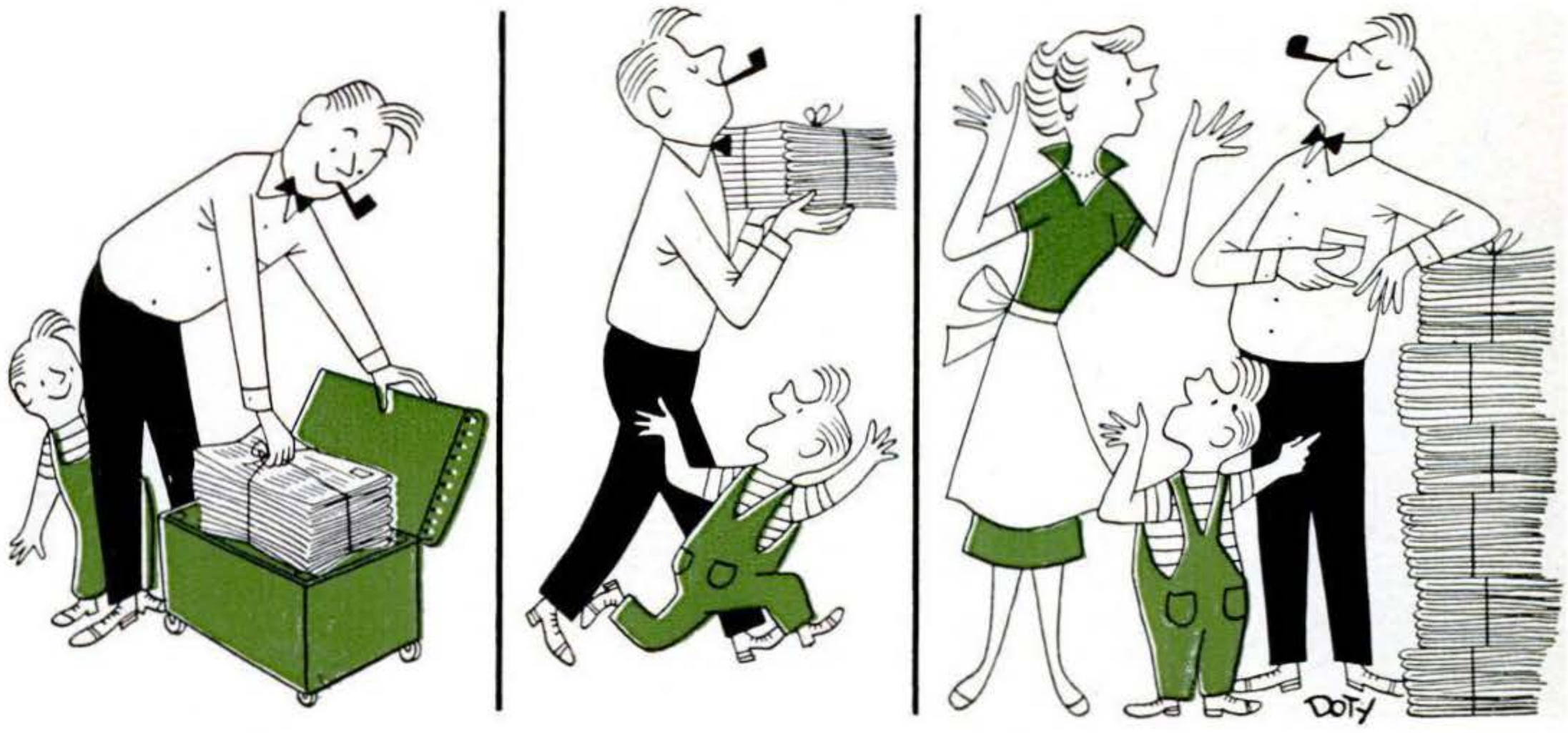

Next Month: A rowboat backrest for easy fishing and rowing

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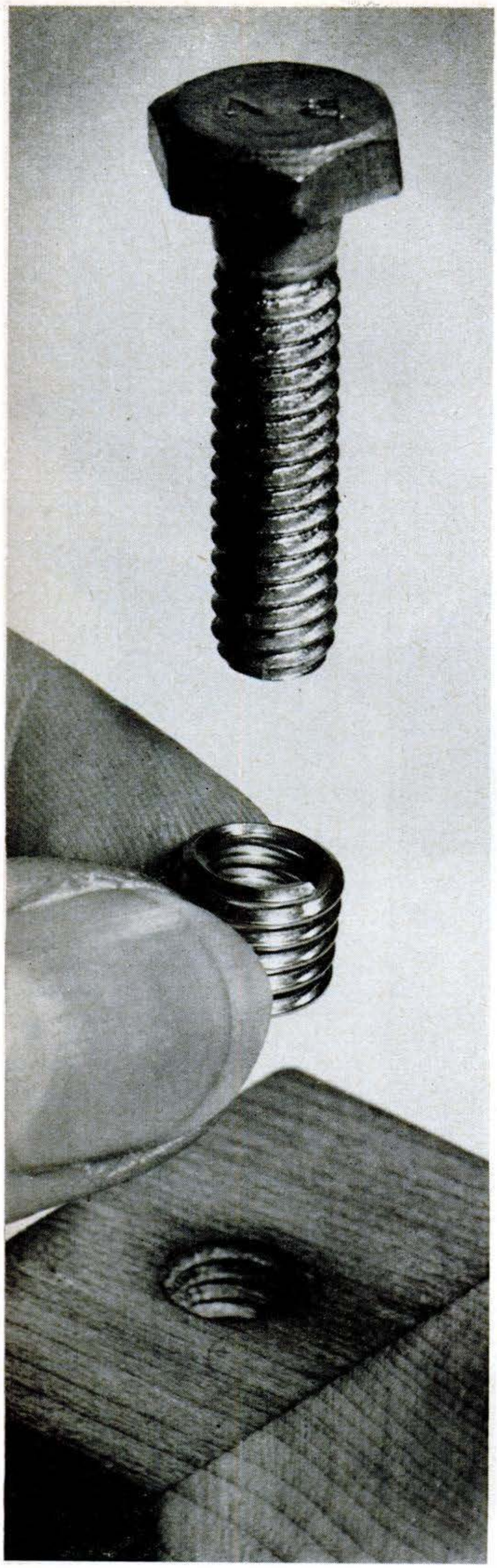

Inside Threads Now Come Ready-Made

BUYING a box of threaded holes sounds like a gag, but your auto-parts dealer probably has them on his shelves. They're little coils of stainless-steel wire called thread inserts.

You'll find many uses for them. The same bolts that won't hold a rattling lawn mower or outboard engine together will tighten firmly in worn bolt holes *renewed* by installing the inserts. Wood, plastic, even marble and tile can be bolted securely together by using ready-made threaded inserts in holes bored in them. Fragile inside threads in soft-metal castings can be reinforced and wear-proofed with the wire liners.

Until recently, the inserts were marketed only for industrial use, but now the Heli-Coil Corp., Danbury, Conn., is putting them out in consumer packages. A separate kit for each thread size contains a quantity of inserts and the tools to install them. Additional inserts can be bought when this supply is gone.

How they're installed. In metal, the worn or damaged thread is drilled out with a drill the diameter of the bolt (¼″ bolt, ¼″ drill). Then the hole is threaded with a special tap supplied with the inserts. Although marked for each thread size, these are oversize taps intended for use only with the inserts. Finally, an inserting tool is used to twist the coil into the threaded hole by means of a tang bent across its bottom end. If the hole goes clear through, the tang is broken off after installation.

Wood, hardboard and plastic can be drilled and tapped like metal to receive the inserts.

Installation in marble and tile differs: Holes are bored slightly larger than the outside diameter of the coils, which are *cemented* in place.

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...flows through your AC Oil Filter every 5,000 miles!

In just 30 seconds while your car's engine is running, all of the oil in the crankcase is pumped through a full-flow oil filter. That's a tremendous total of 36,000 gallons every 5,000 miles. That's why you need a new AC Oil Filter every 5,000 miles to protect your car's engine from damaging dirt, grit, carbon and bits of metal. Any of these can ruin an engine in a matter of a few miles! But an AC Oil Filter removes all traces of foreign matter, as small as 1/100,000 of an inch, without removing the valuable detergents found in most modern motor oils. So, play it safe . . . change your oil filter every 5,000 miles, and insist on a new AC Oil Filter. Your nearby AC dealer has them.

AC SPARK PLUG ⊛ THE ELECTRONICS DIVISION OF GENERAL MOTORS

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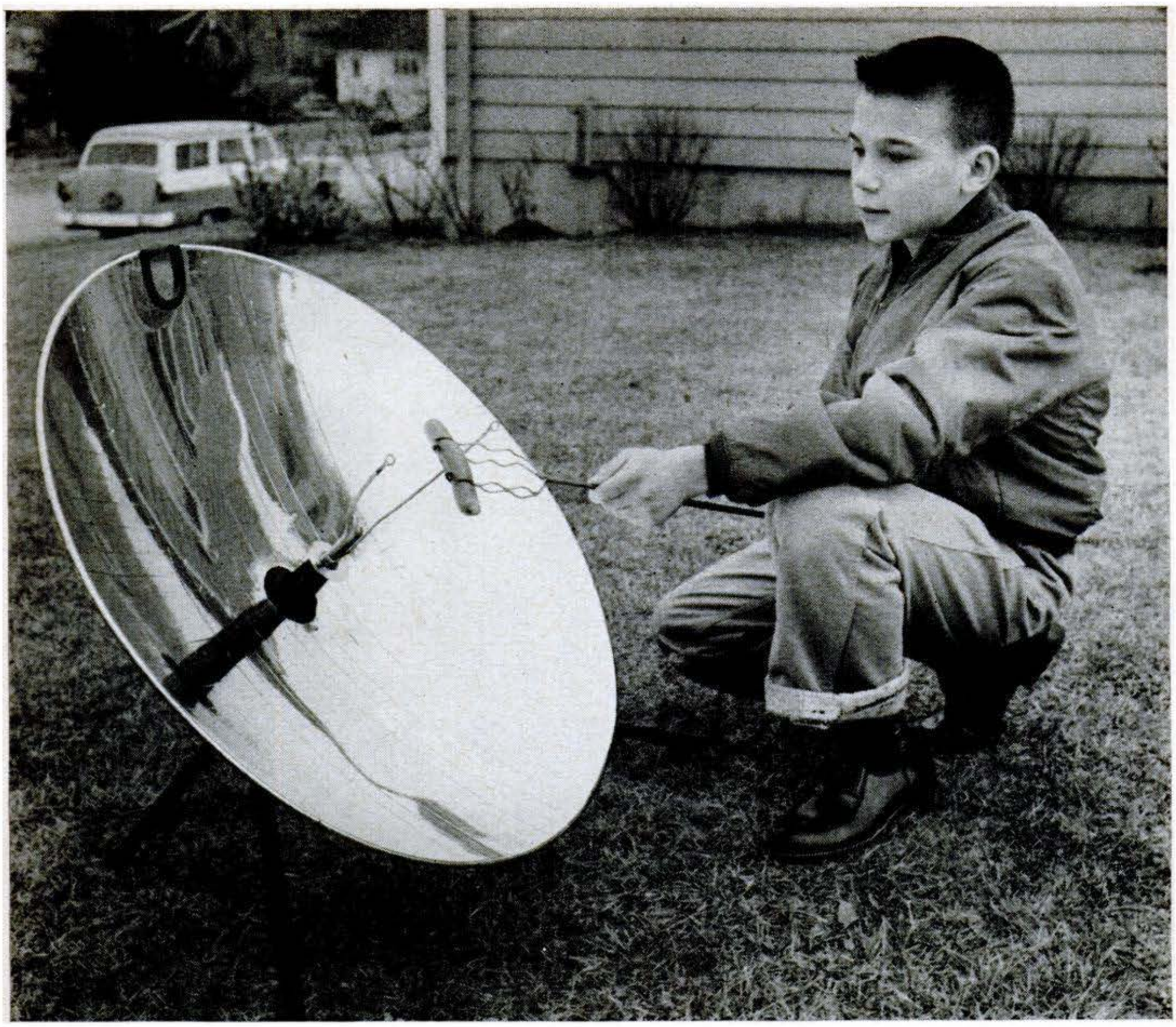

He Grills Hot Dogs on a Solar Cooker

INGENUITY and a surplus radar antenna were combined to produce the solar cooker that Frank A. Leachman Jr. has been using this spring in the back yard of his home at Bristol, Conn.

The 12-year-old schoolboy built the cooker less than a year after becoming interested in solar energy. It works like a charm. Frankfurters grill quickly. With a bit of adult help, he once baked a small pie.

Setting out to build the cooker, Frank found that the antenna's bowl shape was perfect for focusing the sun's rays into a single hot spot 10″ above its center. But its spun-aluminum surface wasn't bright enough to reflect them. That was where the ingenuity came in. Frank simply covered the inside of the antenna with strips of highly reflective chrome tape, giving it a mirror-like finish.

A lamp harp was cut down to support a wire grill in the spot where the sun's rays converge. Electrical terminal lugs secured to the grill and top ends of the harp were joined with small bolts and wing nuts to permit the grill to be leveled when the cooker is aimed low at

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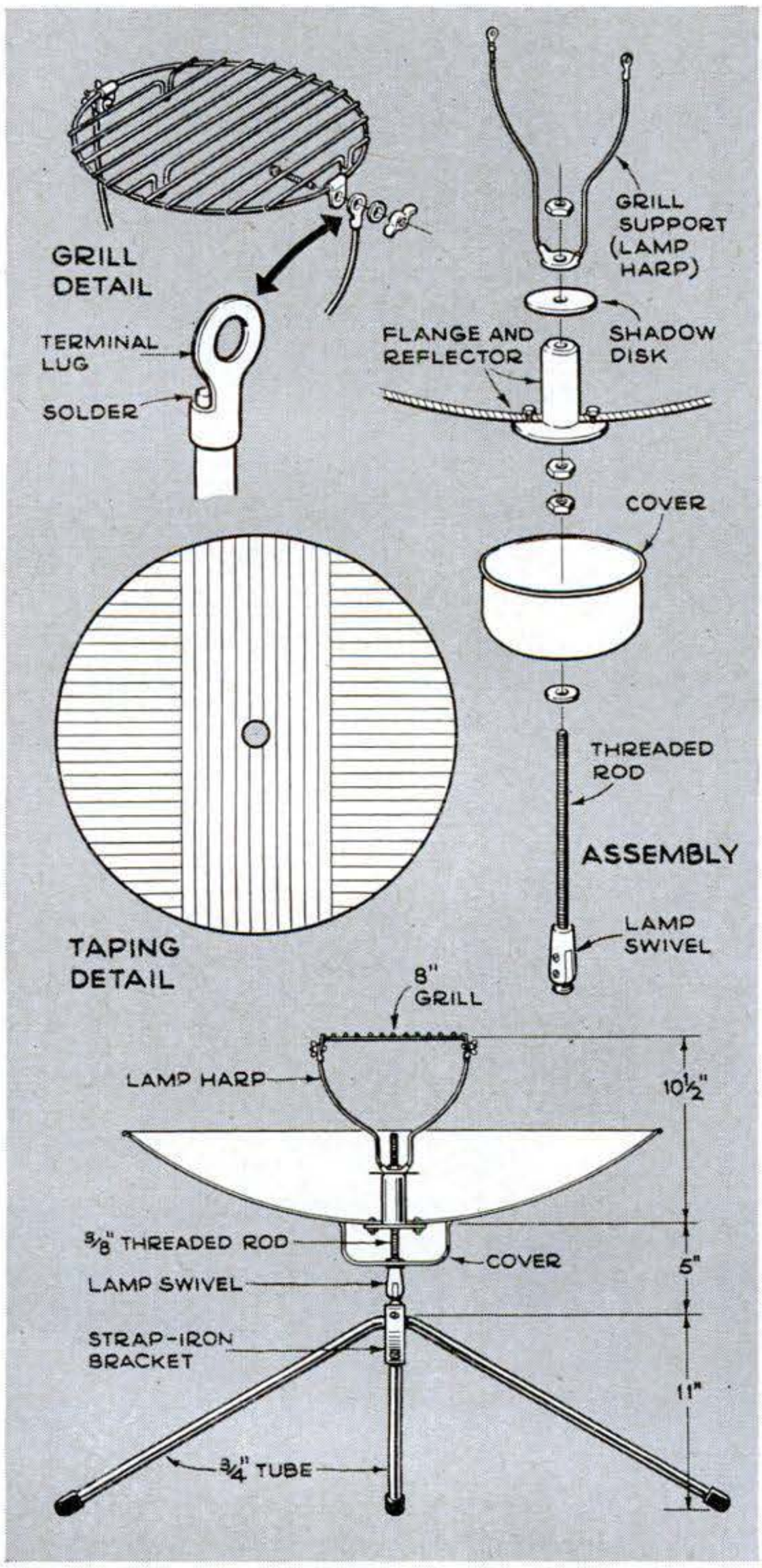
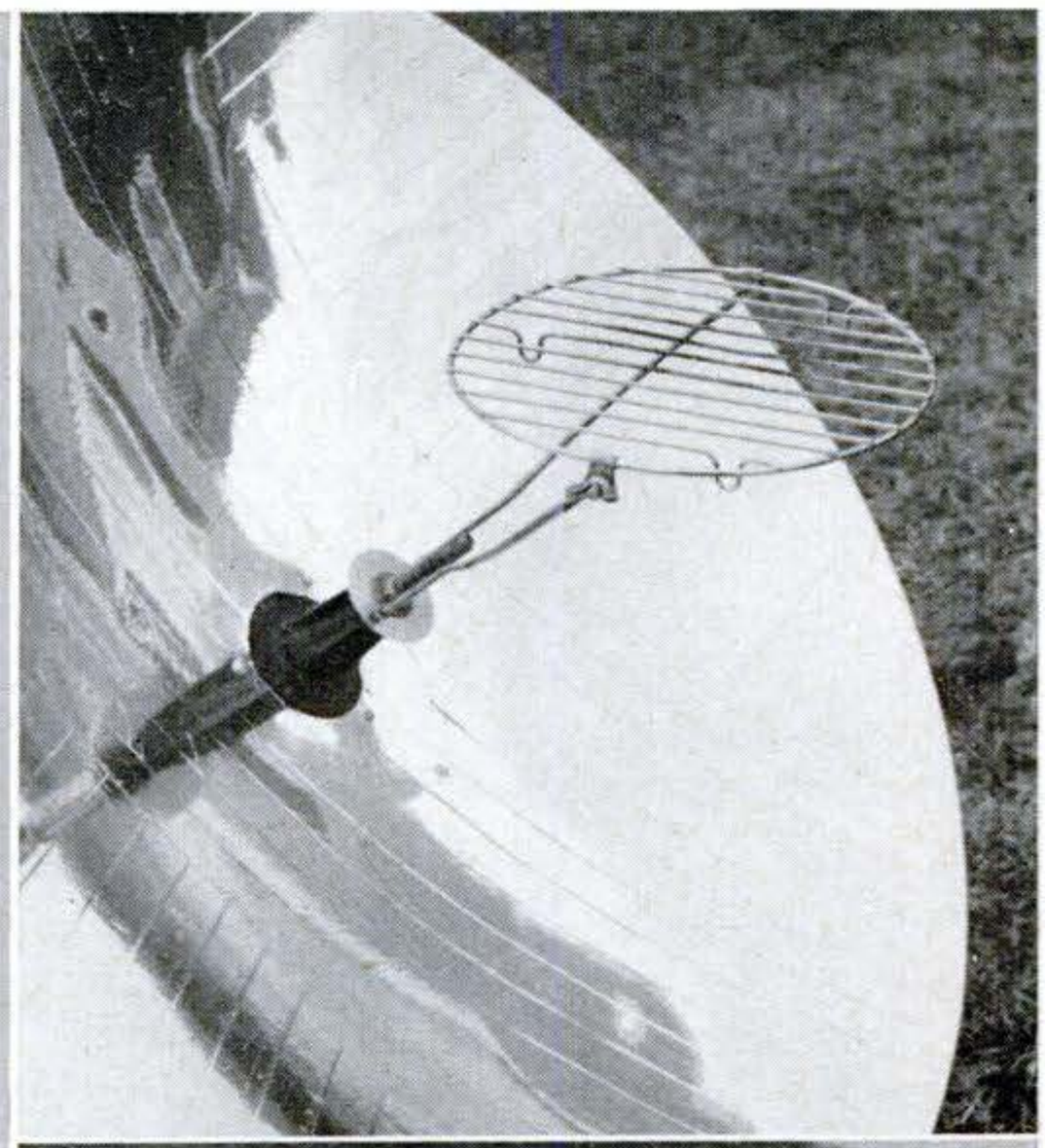
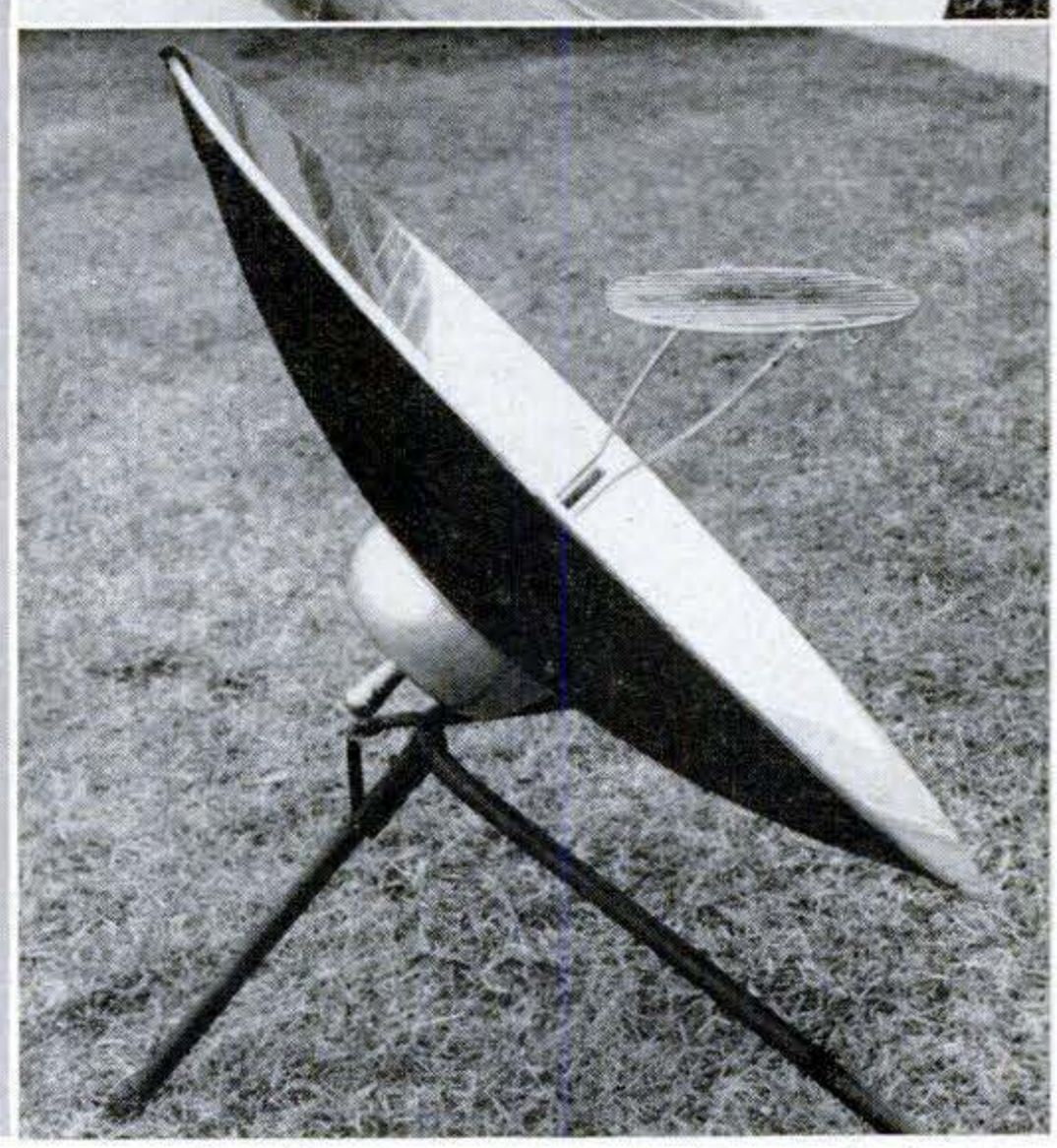
an afternoon sun. The cooker is aimed by checking the way the supporting rod's shadow falls on a small disk below the harp.

To permit it to follow the sun, the entire assembly was mounted on a lamp swivel fastened to a strap-iron bracket and supported by a tripod made of tubing. One long length was bent into an inverted V to form two of the legs, and the third leg was joined to the center of the V with a T connector. A coat of flat-black, wrought-iron paint and rubber chair tips on the legs completed the job.







CONSTRUCTION DETAILS are shown above. Strips of tape were applied in pattern shown to minimize wrinkling. Four nuts fasten all parts to a central rod supported by a flange bolted to reflector. Grill pivots (top photo) so it can be leveled. Cake-tin dome is for appearance.

THE PARTS USED TO MAKE THE COOKER

- 1 30" parabolic radar antenna, 10½" focal length. (Lectronic Research Labs, 715 Arch St., Philadelphia. $7.50)
- 1 roll 1" chrome tape. (Mylar #951, Permacel Corp., New Brunswick, N.J.)
- 1 8"-diameter wire grill
- 1 lamp harp (grill support)
- 4 electrical terminal lugs, 3/16" hole (pivots)
- 2 3/16"-by-½" bolts and wing nuts (for pivots)
- 1 2"-diameter metal plate (shadow disk) with ⅜" hole in center
- 1 9" length ⅜" threaded rod (support rod)
- 4 ⅜" nuts (same thread as rod)
- 1 3"-diameter flange bored ⅜"
- 3 3/16" bolts and nuts (to fasten flange)
- 1 8"-diameter cake tin (bottom cover)
- 1 tension-type lamp swivel
- 1 9" length 1" strap iron (swivel mount)
- 5½ ft. ¾" conduit (cut 4' and 1½' for legs)
- 1 ¾" T connector (for joining legs)
- 3 rubber chair tips for legs

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NEW- Kodak 300

It's ultraportable—yet shows *any* popular-size color slides big-as-life in your living room!

Here's a color slide projector *designed* for modern living! So lightweight, you can carry it like a portable radio . . . so compact, you can store it on a bookshelf. Best of all, it lets you enjoy thrilling *big-screen* projection even in a small room. At a distance of 10 feet, for example, your favorite color slide will *completely* fill a 40-inch-wide screen!

You really have to see and handle the Kodak 300 Projector to appreciate its remarkable versatility. Try the focusing and elevating mechanism . . . the smooth glide of the new Kodak Readymatic Slide Changer. Notice how simply, how precisely, everything works. That's the secret of the Kodak 300 Projector's exceptional handling ease!

Now slip in a slide, switch on the lamp, and focus the lens. Notice that the rock-steady picture you get is brilliantly lighted *clear to the corners!* Your Kodak dealer will be glad to show you the new lamp-condenser system and superb 4-inch, *f*/3.5 lens that produce these superior screen results. Ask him, too, about the Kodak 300 Projector's ultra-quiet cooling system . . . built-in cord and slide storage space. Complete with self-cover.

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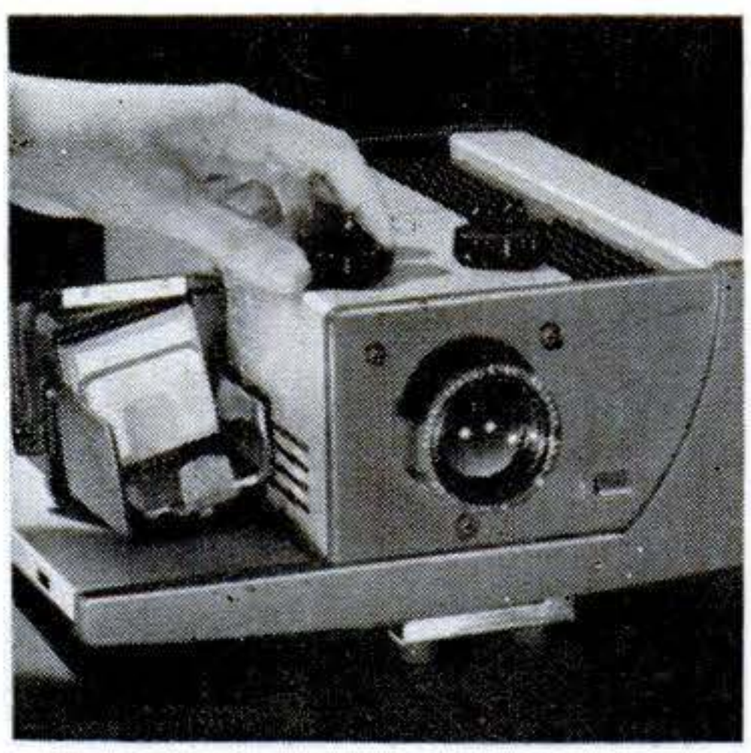

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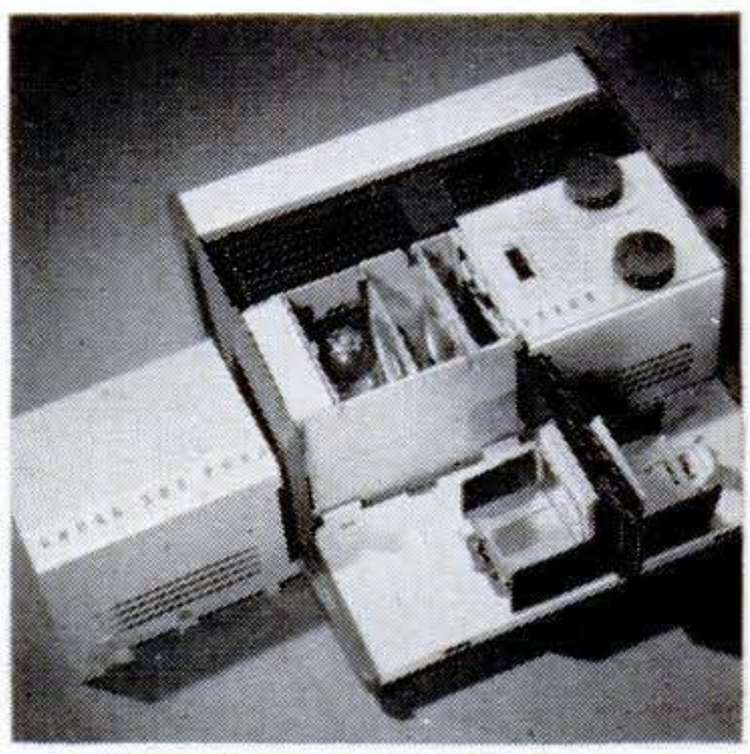

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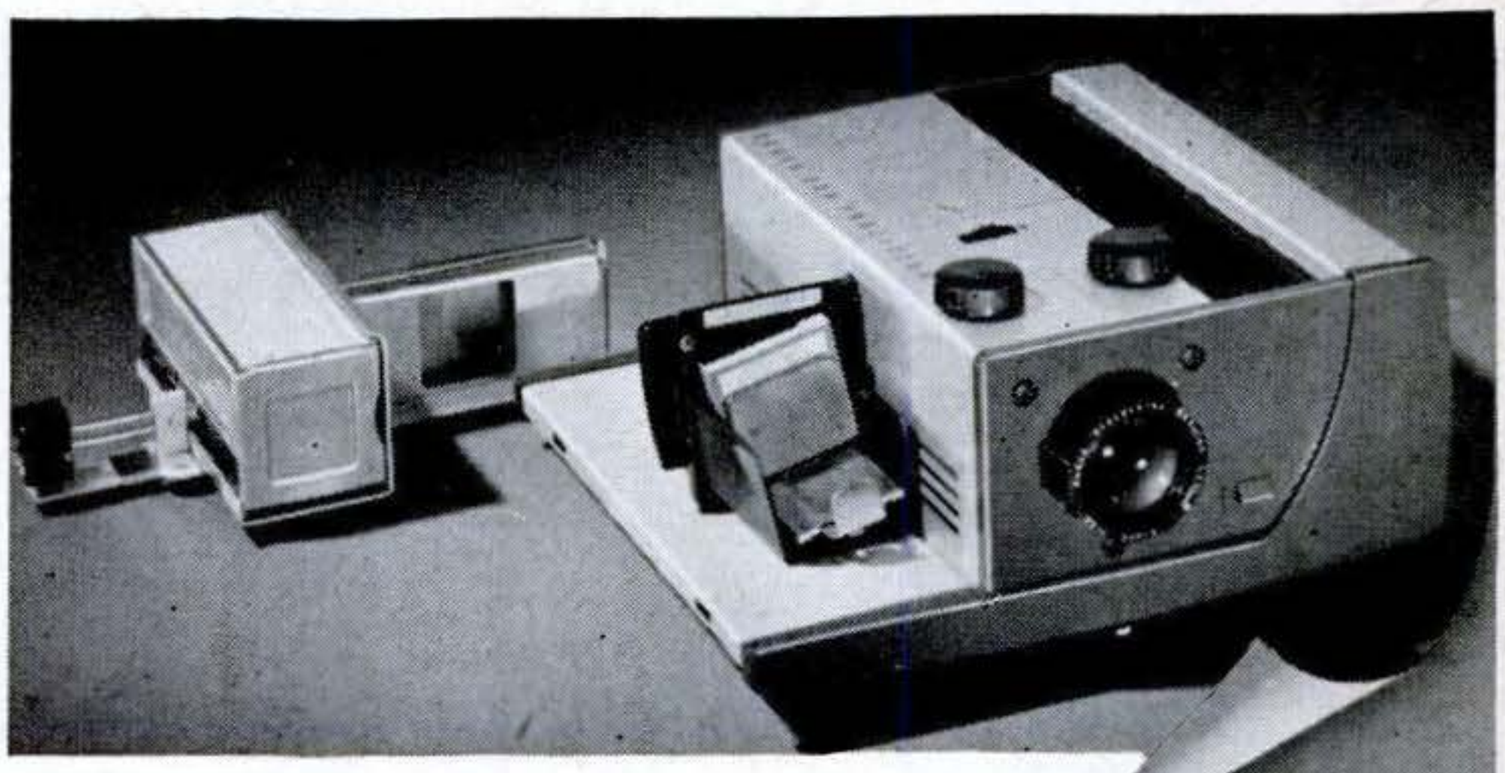

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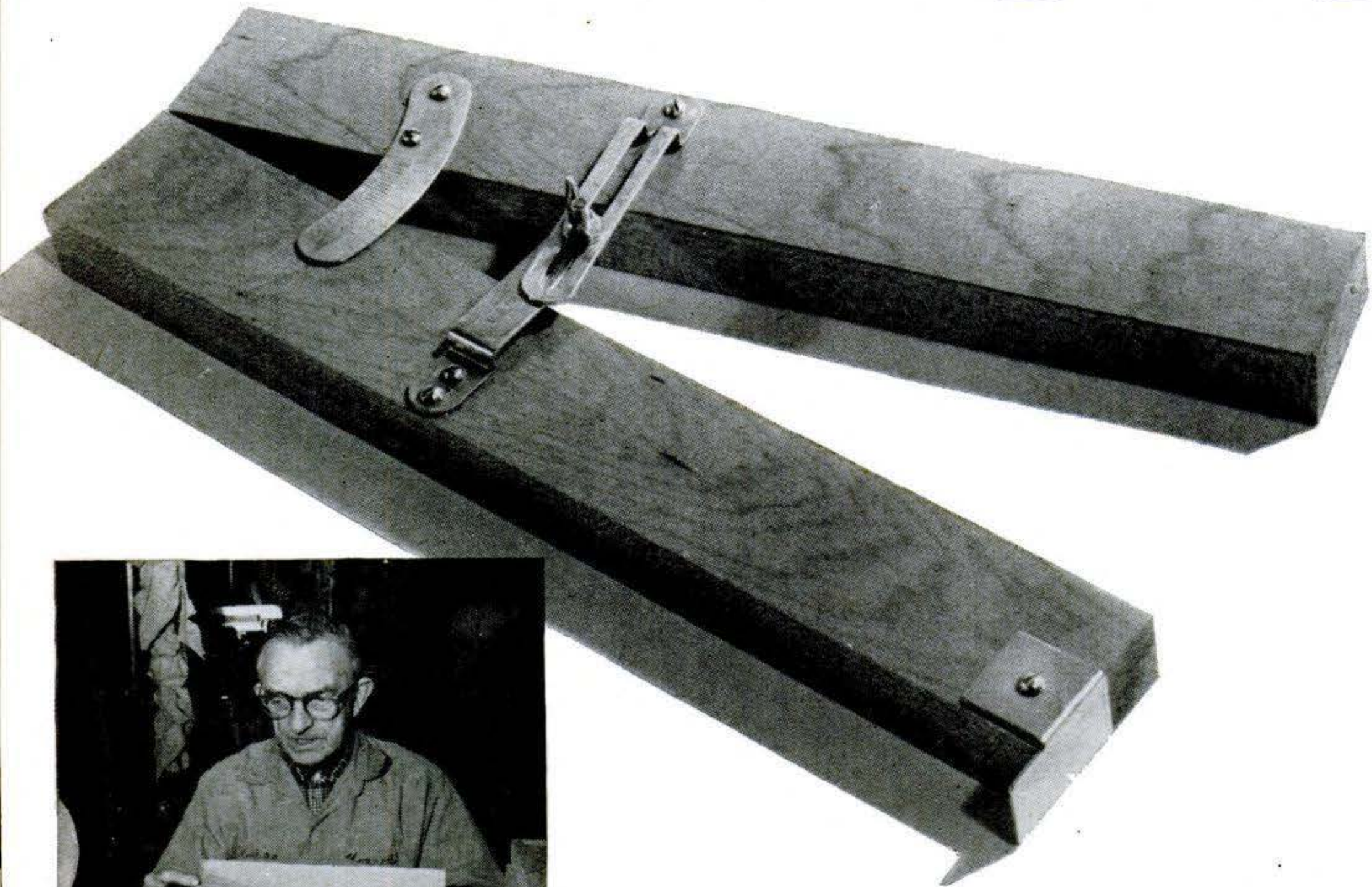
New Angle Pays Off on Old Angle Jig



Adding some new quirks, Frank Cue re-invented the taper jig, got a patent—and now has a good business.

By Lassor Blumenthal

YOU don't have to build a radically new mousetrap to have the world knocking at your door. An old mousetrap that nobody else has been sharp enough to improve, patent and mass-produce may pay off just as handsomely.

That's been the experience of a 75-year-old former railroad traffic manager named Frank Cue.

Four years ago Frank added a few slick trimmings to a very old "mousetrap"—an adjustable taper jig for table saws—and set up a one-man production line in a basement corner of his Hollis, N.Y., home. He's been doing a good business ever since. Last year he made and marketed more than 2,000 jigs, and he still can't keep up with demand.

When he retired in 1953, Frank was looking for a hobby, to ease the boredom of too much leisure. He had never done anything much more mechanical than replacing burned-out light bulbs. But now he had a yen to make some really high-class furniture. So he bought himself a modern combination power tool.

A coffee table with tapered legs was one of his first projects. This presented a problem. The miter gauge that came with his power saw couldn't be set for an angle of less than 30 degrees. Frank says, "I went to my dealer and he told me that I'd have to build a special jig to get the taper I needed.

"That annoyed me since my next proj-

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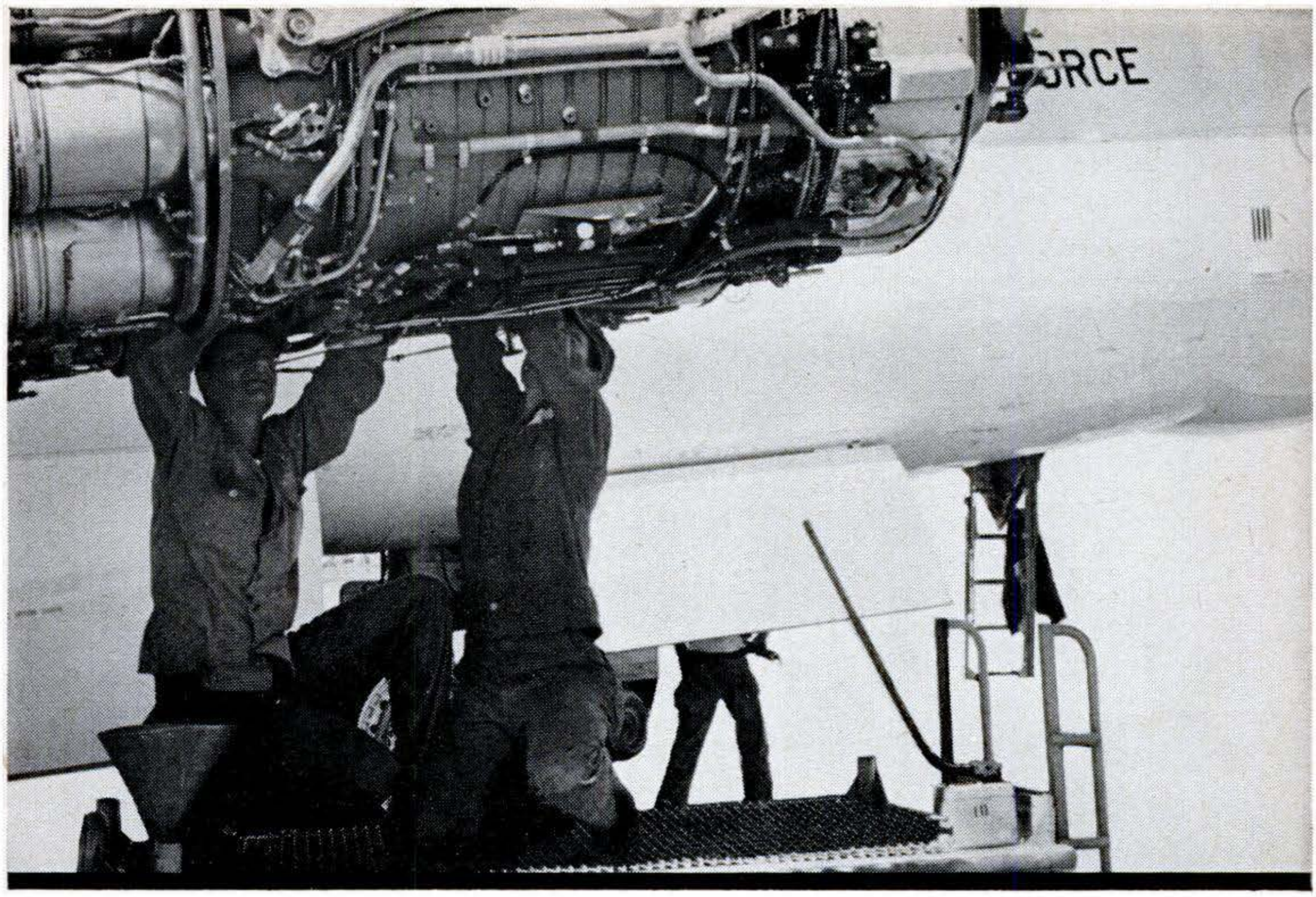

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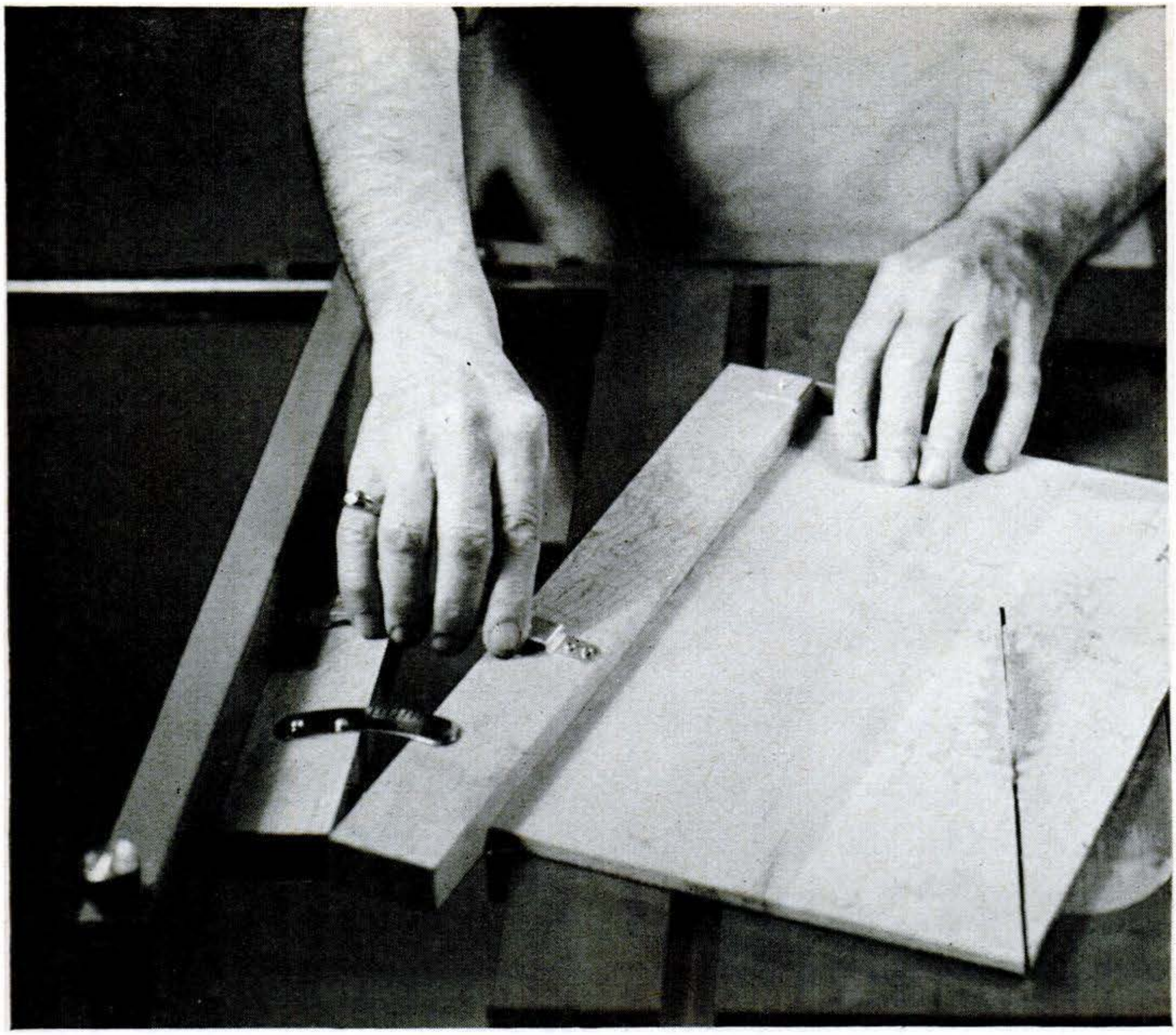

ANGLE BETWEEN THE TWO ARMS of Frank Cue's taper jig is duplicated by the blade when the jig advances stock across the saw table. Here, Frank demonstrates possible danger if stock had to be backed by hand. The metal tab at the end of the jig arm makes this unnecessary.

ect might call for still another jig. I started doping out an adjustable one to give me any angle I wanted."

A few months later, he had come up with a design that satisfied him. He didn't know that he had re-invented a table-saw accessory that already existed —in one home-made version or another— in hundreds of work shoppers' basements and cabinetmakers' shops.

Frank's adjustable taper jig consisted of two hardwood arms, each ⅞″ by 1¾″ by 12″, joined by a hinge at one end. The hinge allowed the two pieces to pivot open in a V shape, giving any angle from zero to 24 degrees. To use it, you placed one arm flush against a table saw's rip fence, moved the other arm outward to the angle desired, and locked the two arms in position with a wing-nut clamp. Against the outer arm you then placed the stock to be cut, and advanced it, along with the jig, across the saw table. The blade ran off precisely the right angle.

Delighted with his "invention," Frank decided he had a marketable product. Leafing through POPULAR SCIENCE, he found the address of a patent attorney near his home. He looked him up, and the attorney was impressed. He had one of his draftsmen draw up a plan and specifications. These were sent to the Patent Office.

Soon, Frank got the bad word. The patent was disallowed. A Texan had patented an adjustable-angle jig back in 1934, and the boys in Washington felt

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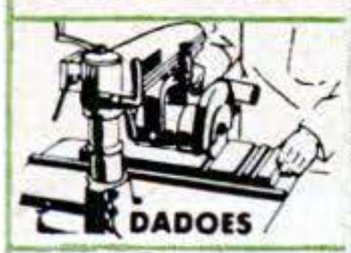

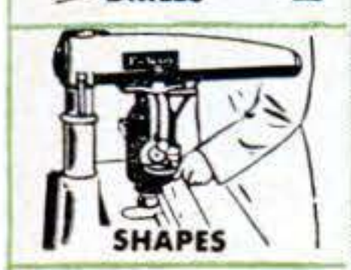

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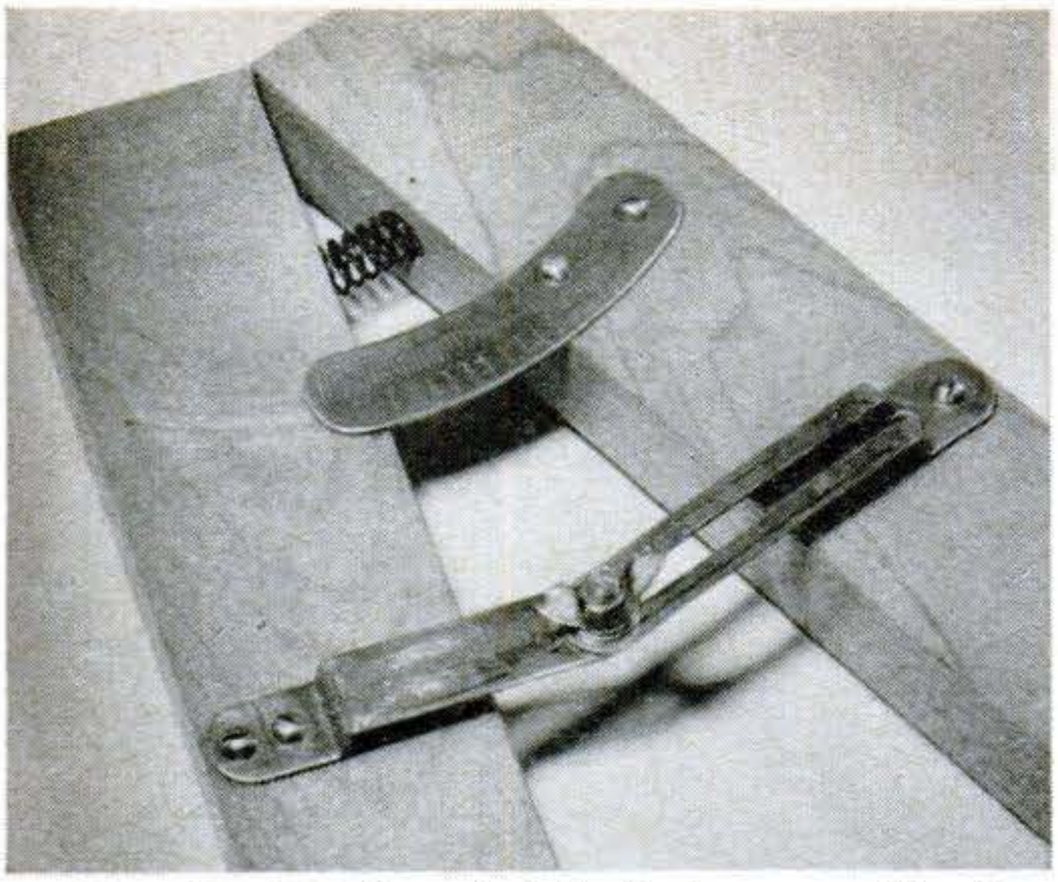

A COIL SPRING inserted in holes near the forward ends of the jig arms, and anchored with brads, both holds the lead edges firmly together and acts as a hinge. The protractor gives an accurate angle reading in both degrees and inches. The clamp below it holds the setting.

that Frank's jig design was too similar.

Frank disagreed. One look at the patented plans convinced him that his own jig was lighter, simpler and cheaper to produce. He sent in his application again, this time calling attention to the differences in design. The patent was allowed.

Setting up a business was Frank's second problem, now that his persistence in getting a patent had paid off.

Because his workshop space was limited to a 15-foot-square basement area, he decided against buying quantities of long boards and cutting them down to size. Instead, he'd farm out that part of the job. This way, he could stack the hardwood for 1,000 jigs in a pile not much larger than a TV console.

A good idea, but it nearly backfired. Not having done business of this sort before, Frank agreed to pay a 50-percent deposit on the first 2,000 jig arms. As soon as he learned that the package was on its way, he sent a check for the balance.

When the wood arrived, a quarter of it was riddled with knots. Frank hurried to the bank, stopped payment on the check, returned the bad pieces, and paid only for the ones he could use.

Although now in production, he tried constantly to improve his product. He added a metal tab to hold the wood against the jig as the saw was going through it. This meant that an operator didn't have to put his hand near the blade. Next, Frank straddled a protractor between the two arms to show, precisely, the angle between them.

Being new in the game, he understood the amateur's problems. "At first, I just marked the protractor for degrees," he says. "Then I figured that a novice would find it easier to work in inches, so I marked it both ways.

"When I went to have the protractor dies cut, I learned another lesson. I gave the diemaker a $25 deposit and a sample of the protractor, all properly marked. When the die came back, the numbers were reversed. Well, I lost the $25. But that was the last time a supplier ever saw the color of my cash until I was sure I was getting what I'd ordered."

The response to Frank's first small advertisements was so gratifying that he took the jig to a few large hardware stores. It was snapped up eagerly. Better yet, a couple of nationally known mail-order houses agreed to picture it in their next catalogues. Now, Frank had a going business on his hands.

Today, his business is not only going. The jigs are growing. Frank started by offering 12″ and 15″ models—suitable for home workshops. But word spread in the furniture business that a man named Cue had come up with a time-saving idea that could be used in commercial plants.

Frank took the hint. Now, he's working on a 24″ professional model. It's similar to his earlier jigs, but there's a big difference in the hinge. On the home-craftsman models, he uses a coil spring set in two bored receptacles and anchored with cross-pins. His professional model, however, has a regular butt hinge to give added rigidity, useful in heavier work. Both hinge types are covered in his original patent.

What's the moral to this success story? Frank says, "Look about you. Your own money-maker may be lying on your workshop table right now." END

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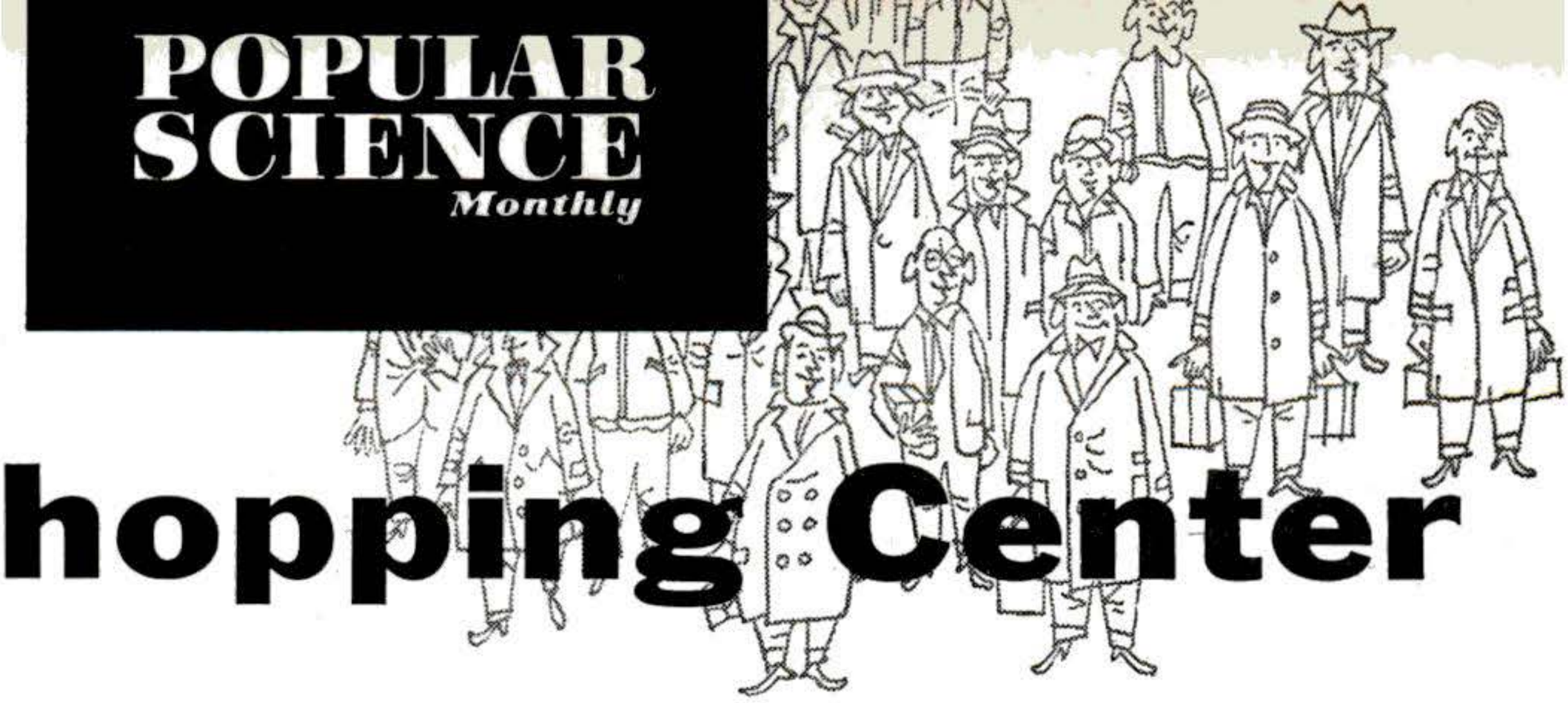

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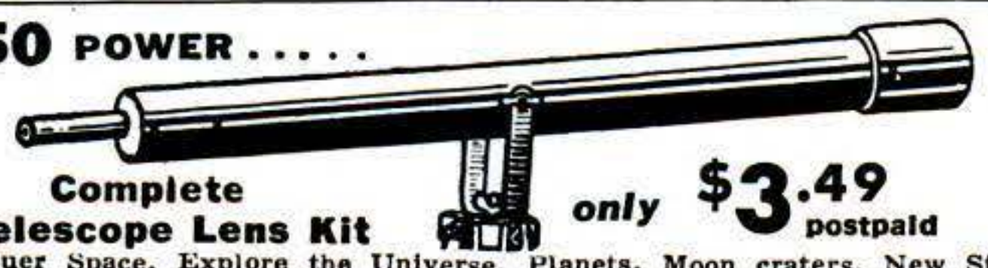

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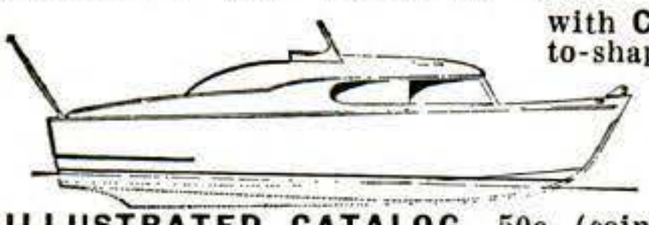

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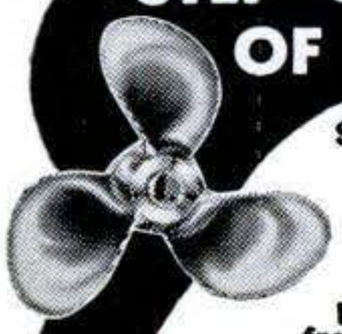

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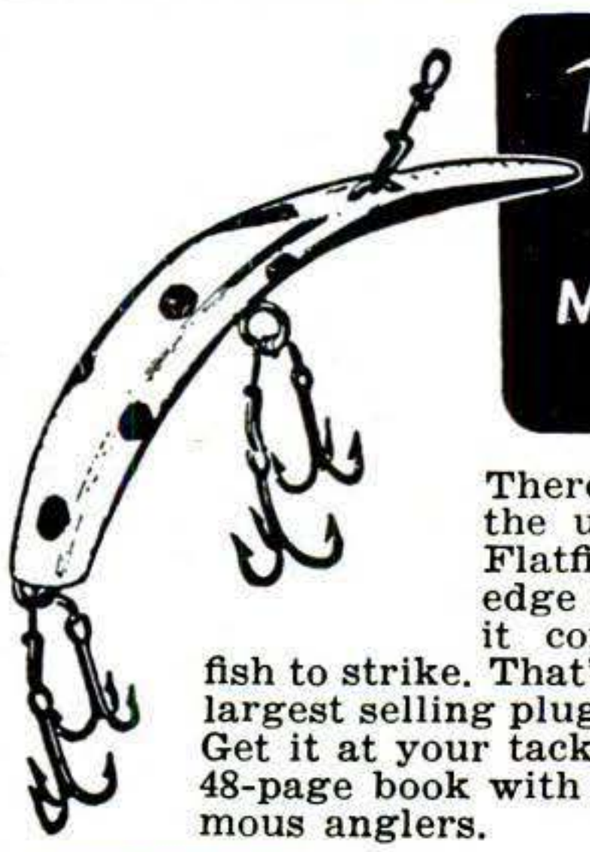

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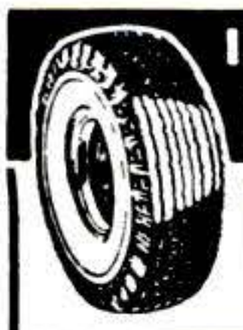

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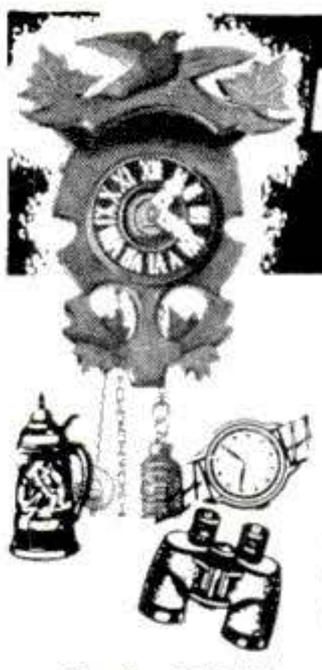

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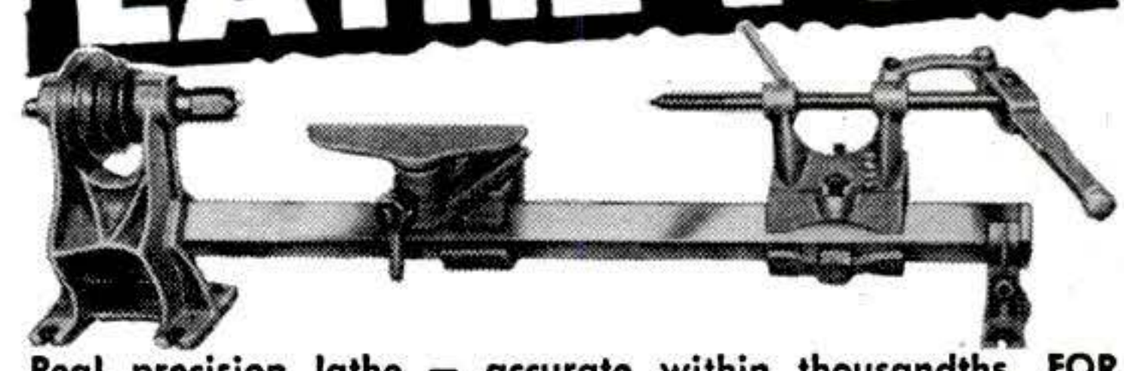

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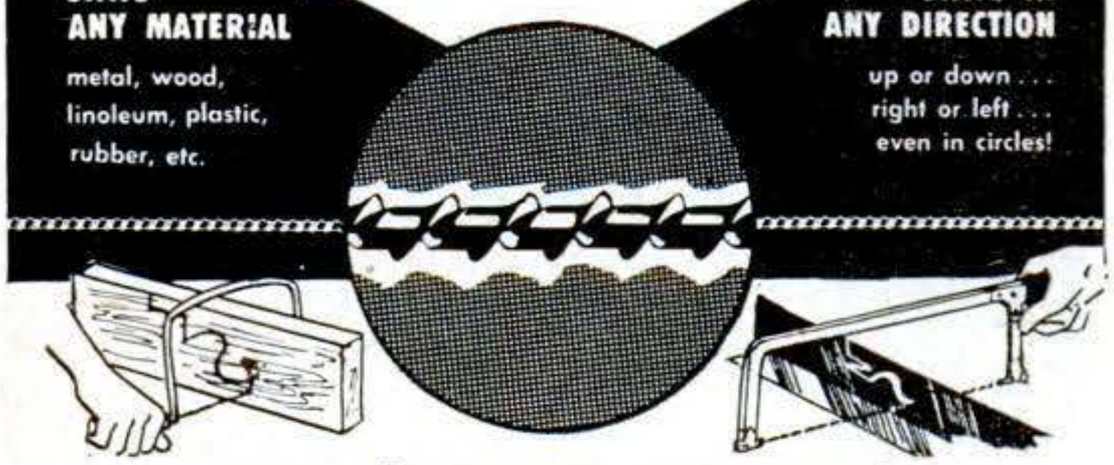

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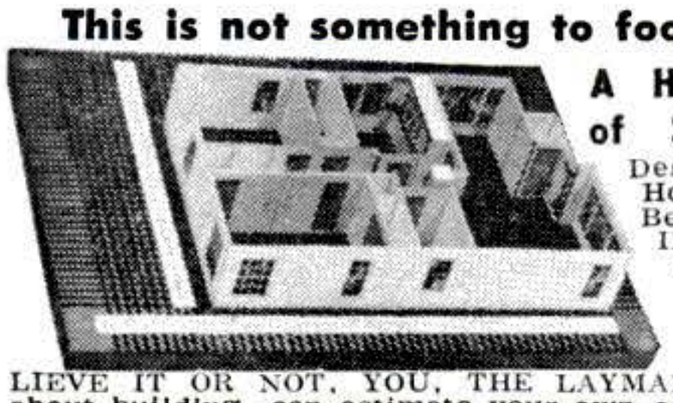

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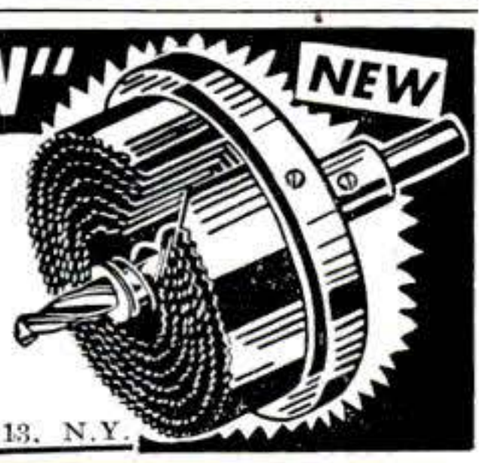

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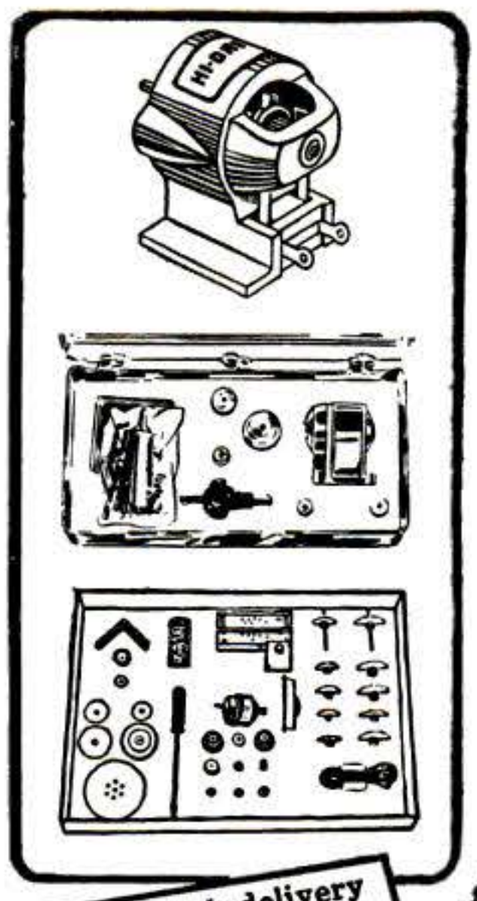

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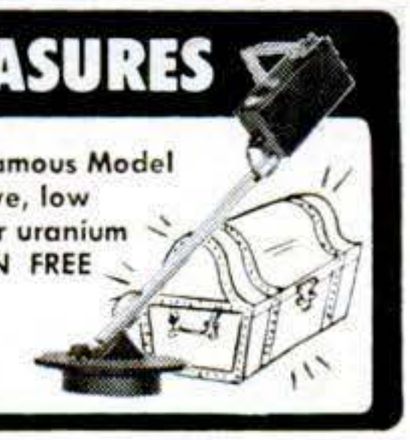

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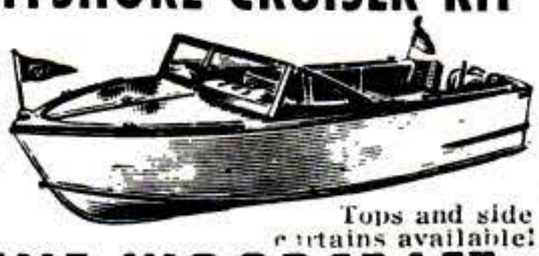

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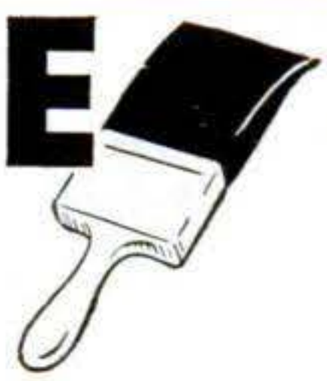

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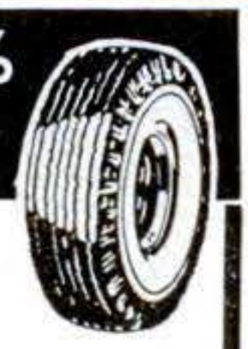

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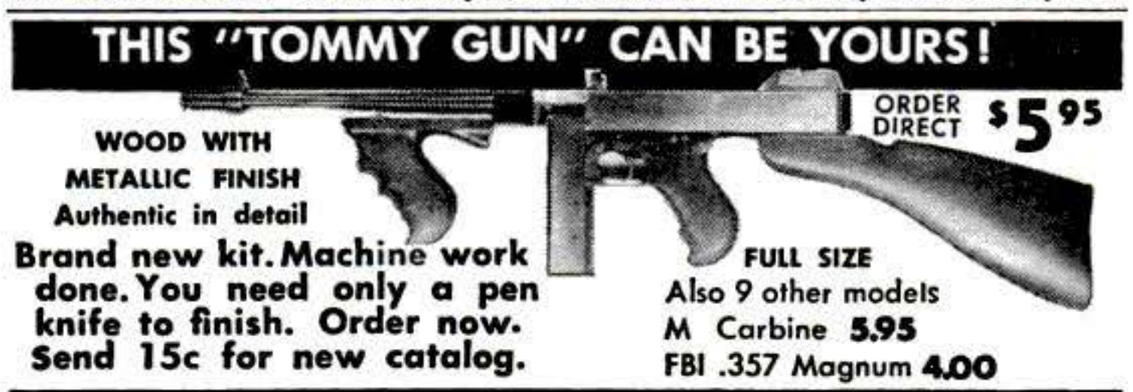

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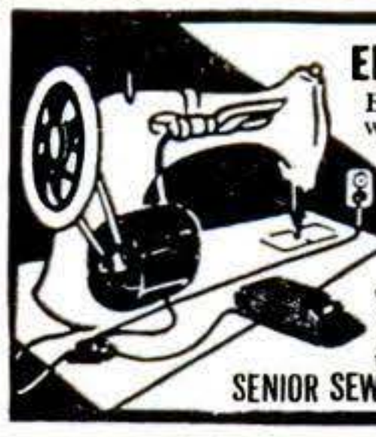

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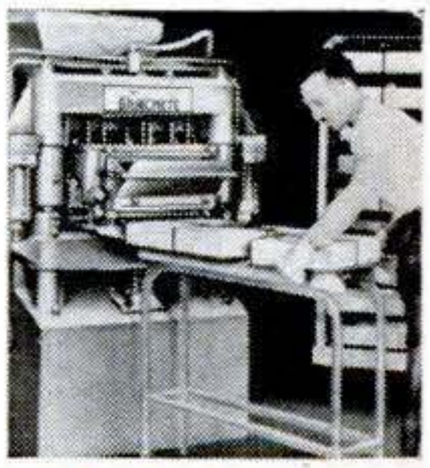

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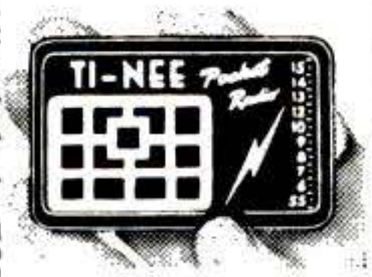

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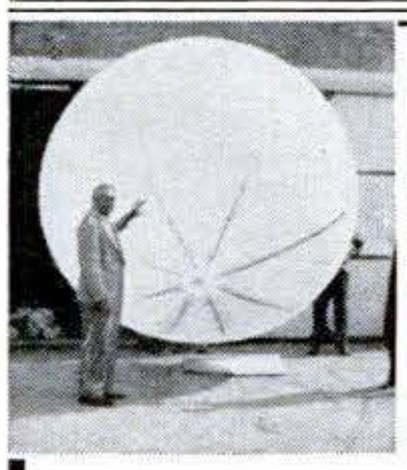

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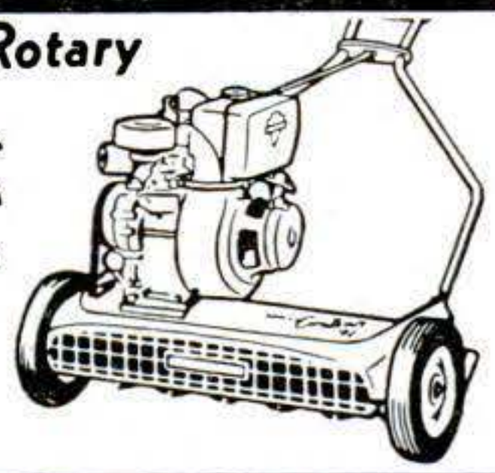

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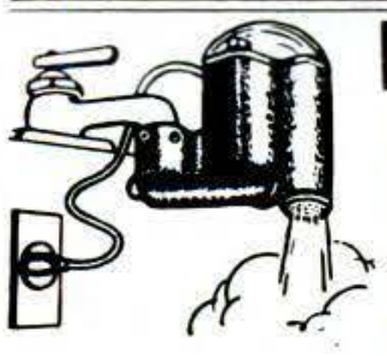

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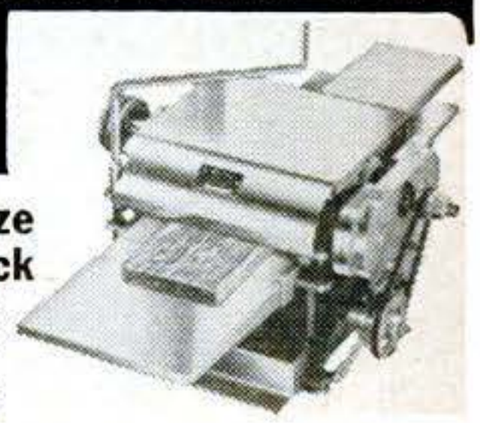

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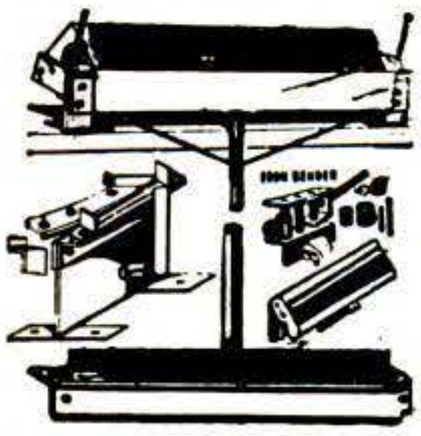

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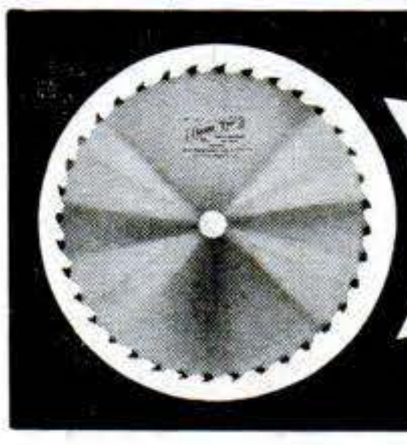

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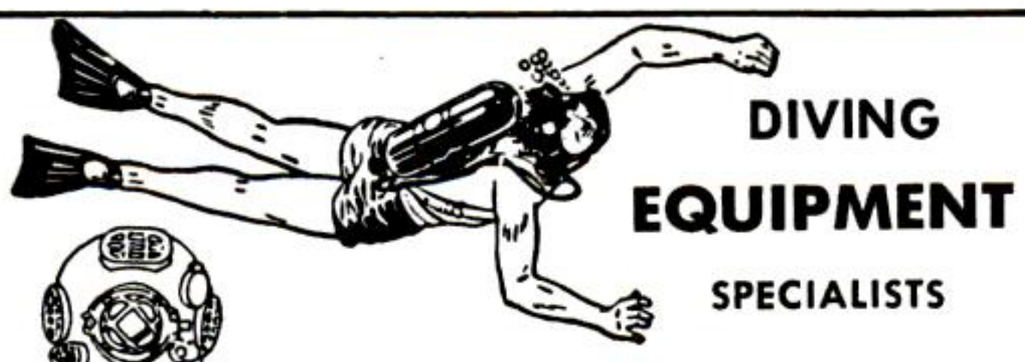

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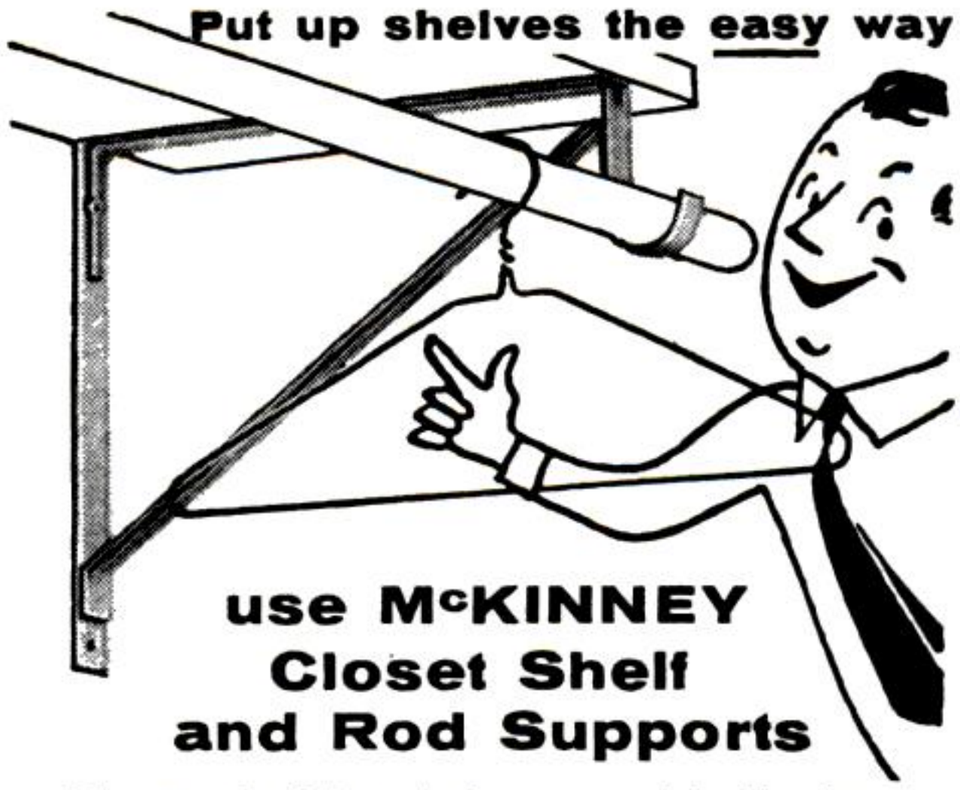

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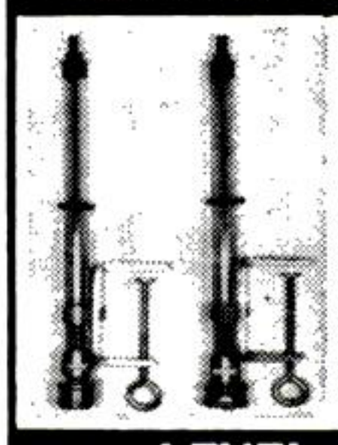

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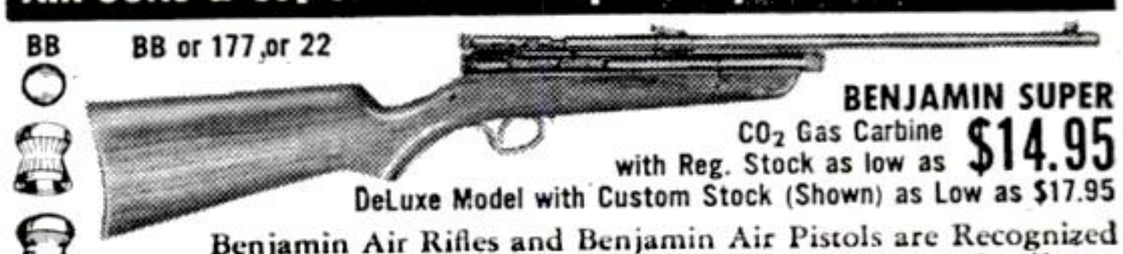

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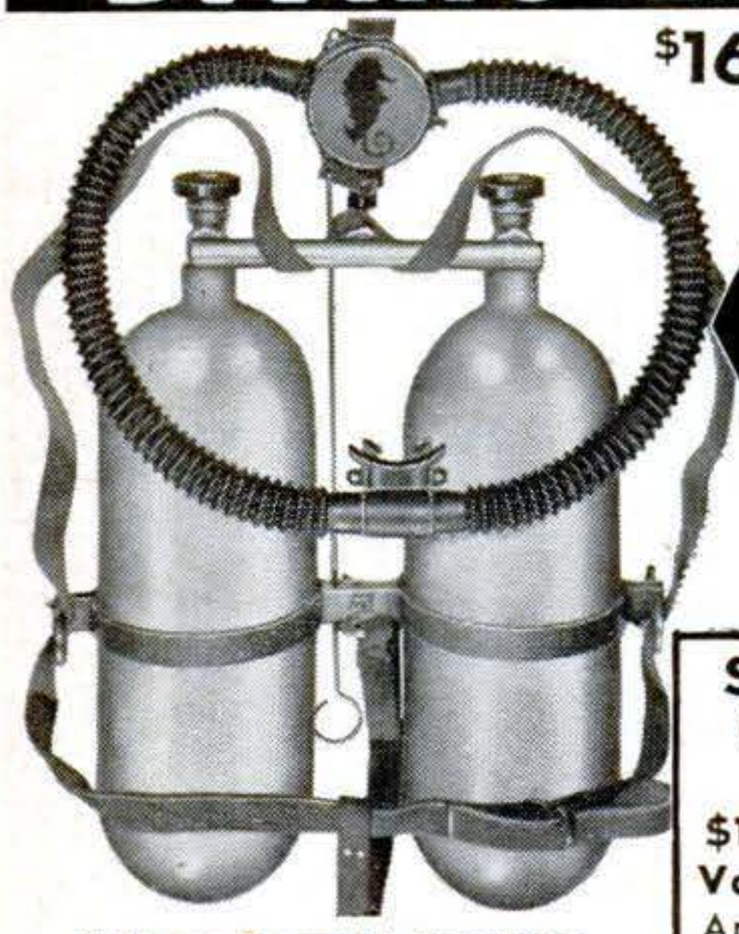

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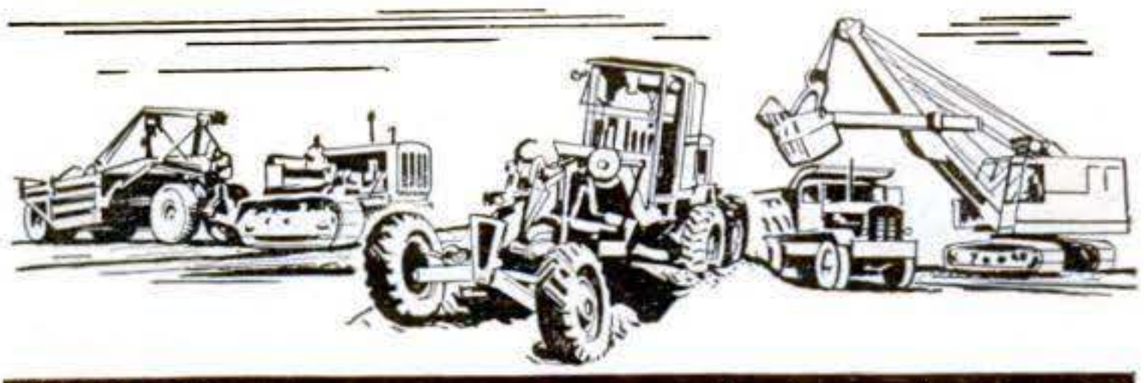

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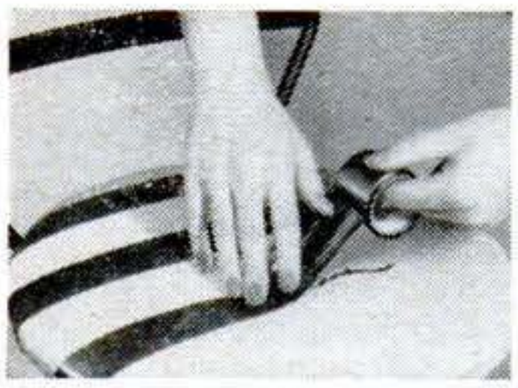

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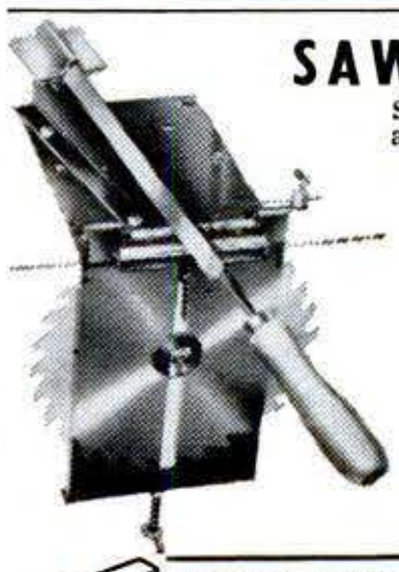

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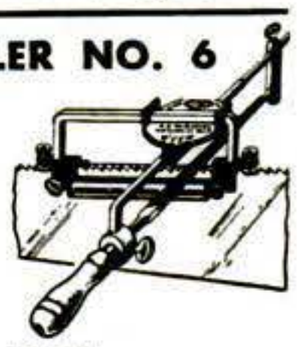

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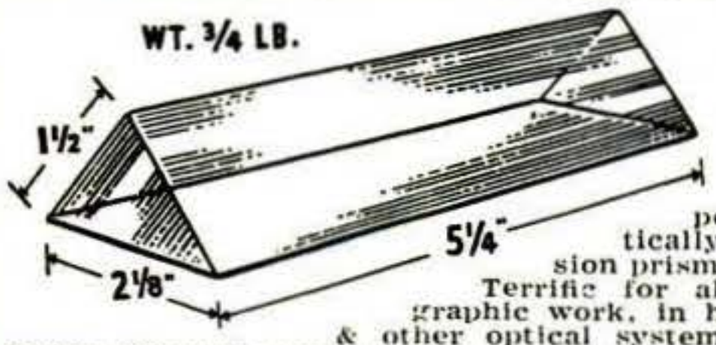

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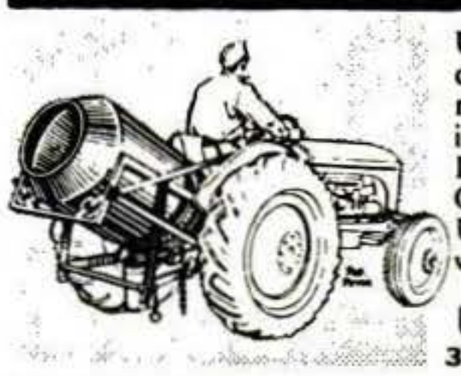

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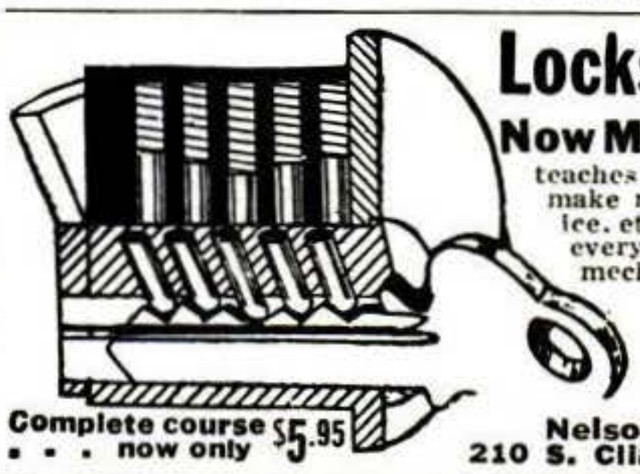

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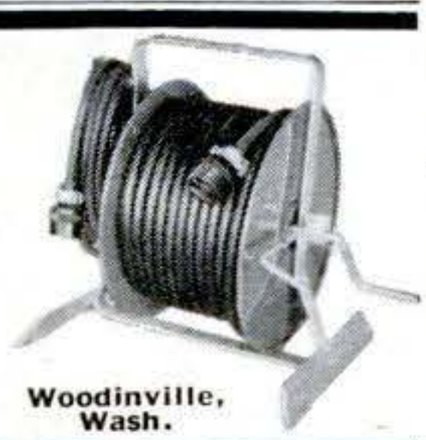

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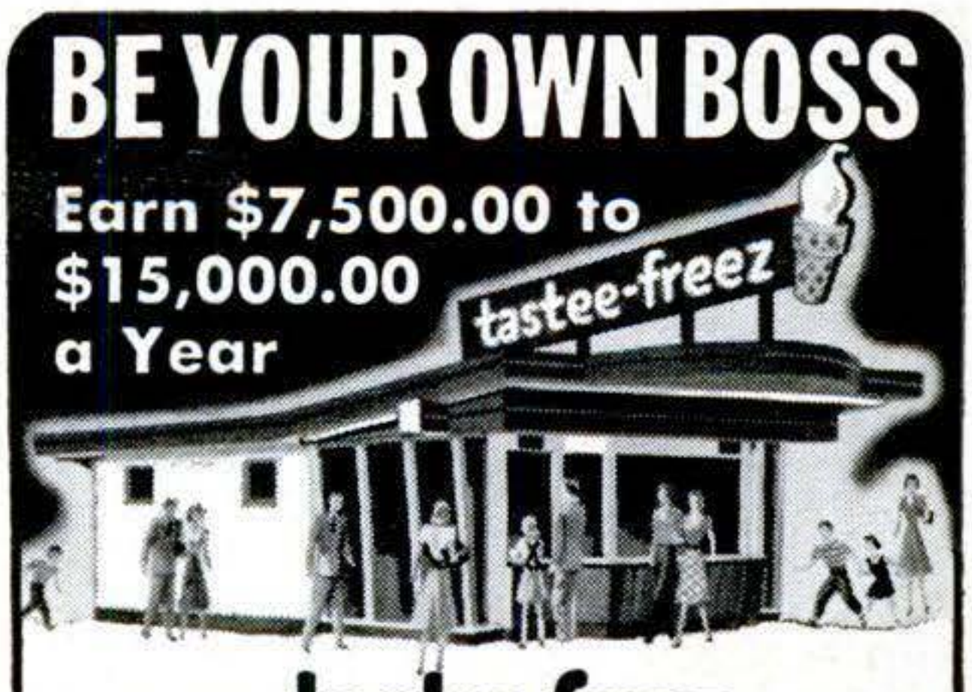

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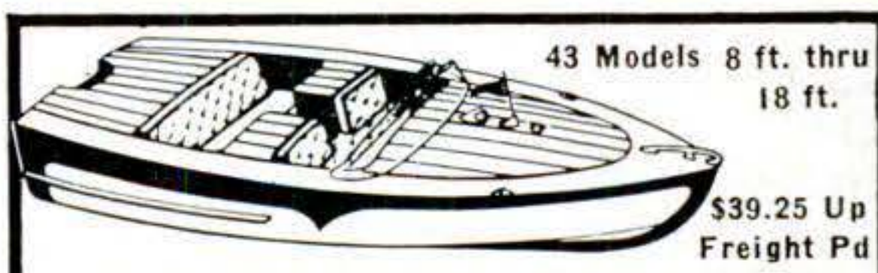

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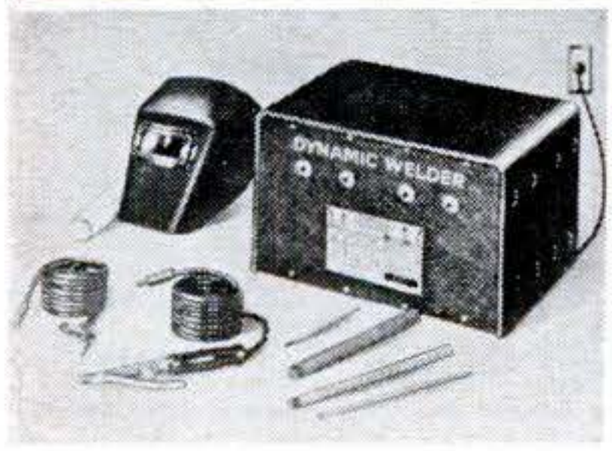

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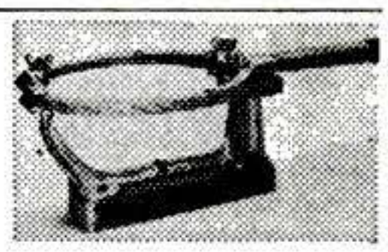

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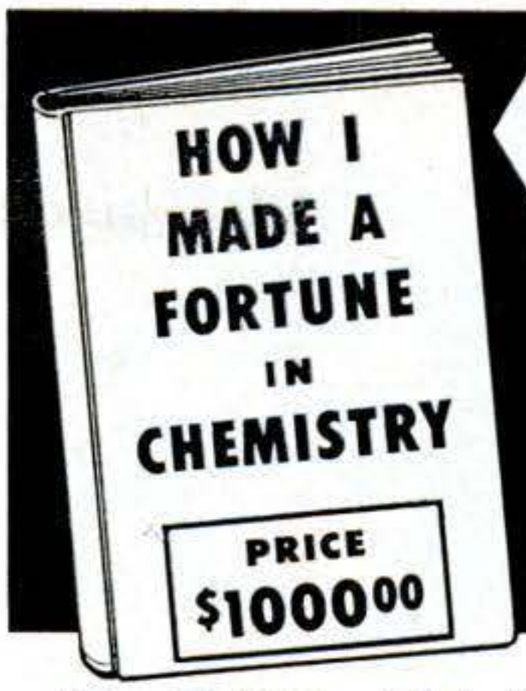

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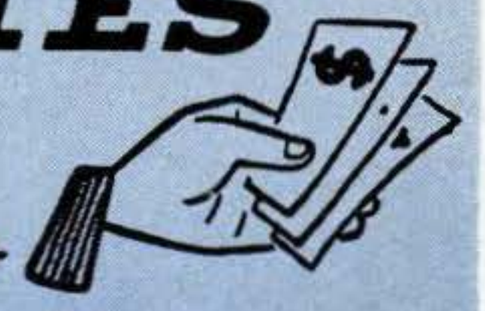

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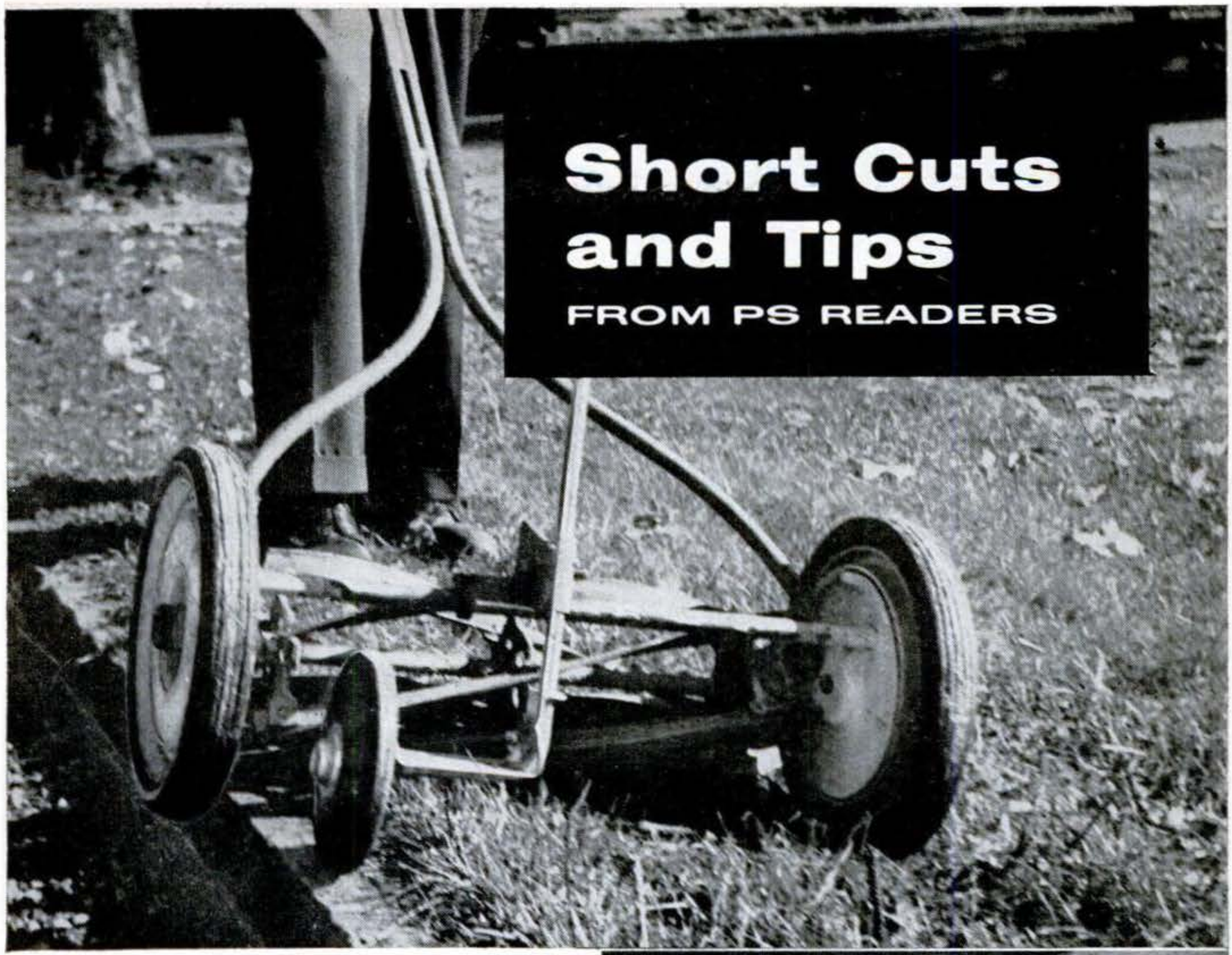
Short Cuts and Tips

FROM PS READERS



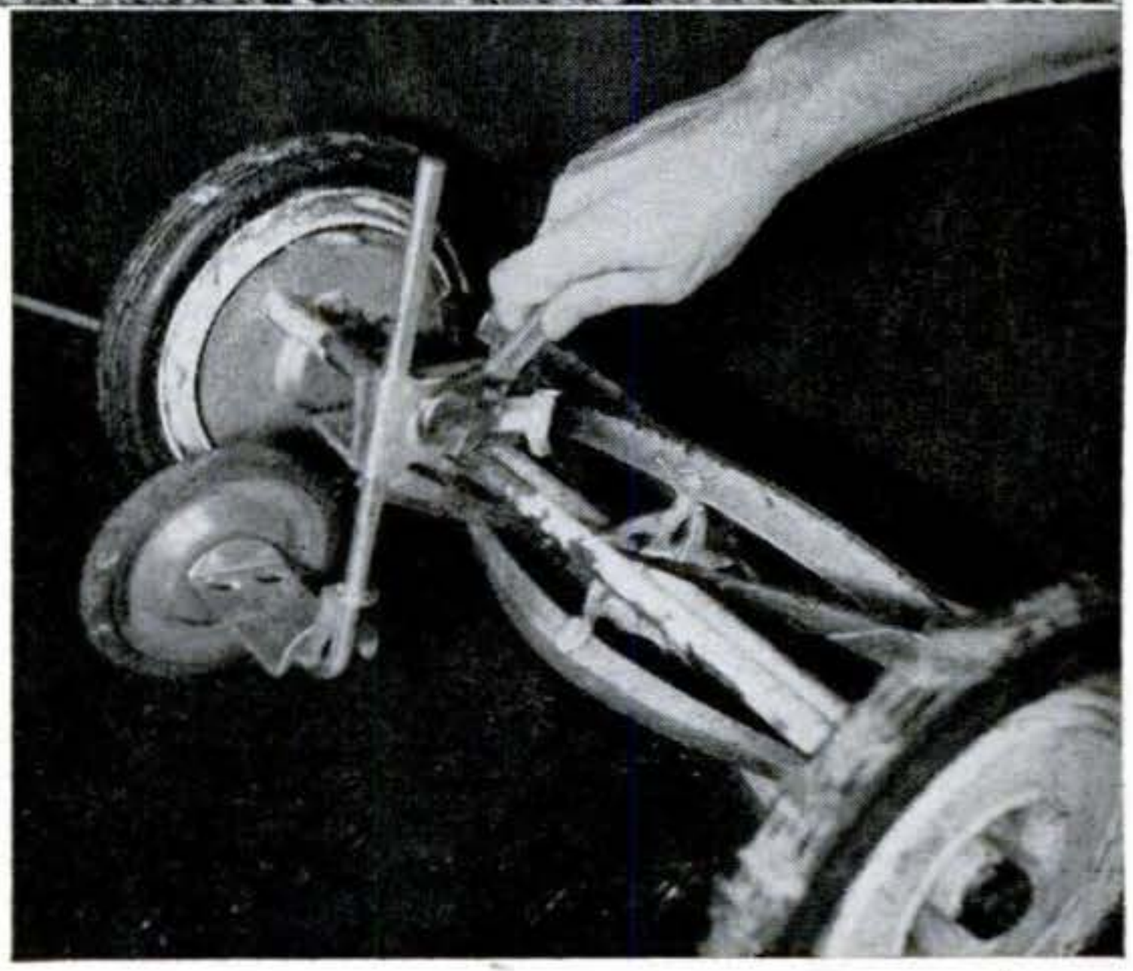
Three-Wheel Mower Trims Grass Close to Curb

WHEN cutting grass next to a curb, it is easy to end up with one mower wheel dropping off the edge and the blades digging into the soil. I got around it by putting a third wheel on my mower —a small bicycle-training wheel that had done service for my youngster.

Set 2″ in from one end of the reel and adjusted so it just touches the ground, it doesn't get in the way of ordinary cutting and is ready to take hold on the curb when the mower wheel slips off.

I welded a piece of angle iron to the upper spacer bar after drilling one face for a ½″ bolt. Then I bolted the training-wheel bracket loosely to the angle iron, inserted and adjusted the L-shaped axle, and drew the nut tight.—*Arthur R. Tanner Jr., Poughkeepsie, N.Y.*

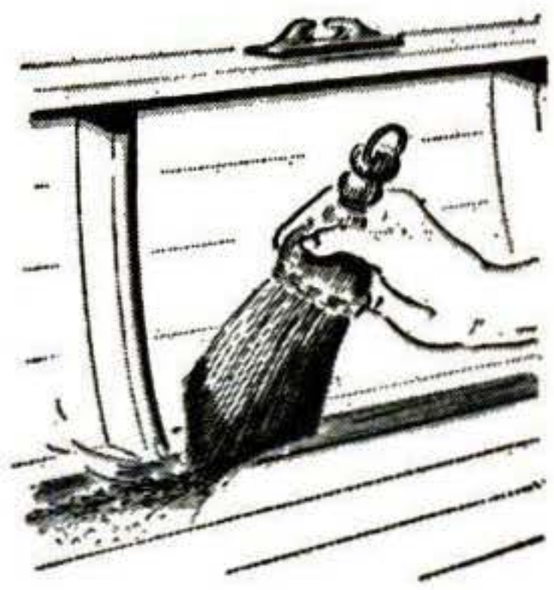
▶▶▶A PLUMBER in my neighborhood carries his root-cutting drain cleaner coiled in an old tire casing. With the 85′ cable inside, the tire can be lifted out of the truck easily and rolled to the work spot.—*S. Rouse, Lewisville, Ind.*



Pointed Broom Cleans Corners

I USE a whisk broom, with its bristles cut to a V shape, to keep my flat-bottomed boat clean.

The pointed part gets into corners nicely to brush out dirt and sand.—*Thomas P. Ramirez, Fond du Lac, Wis.*



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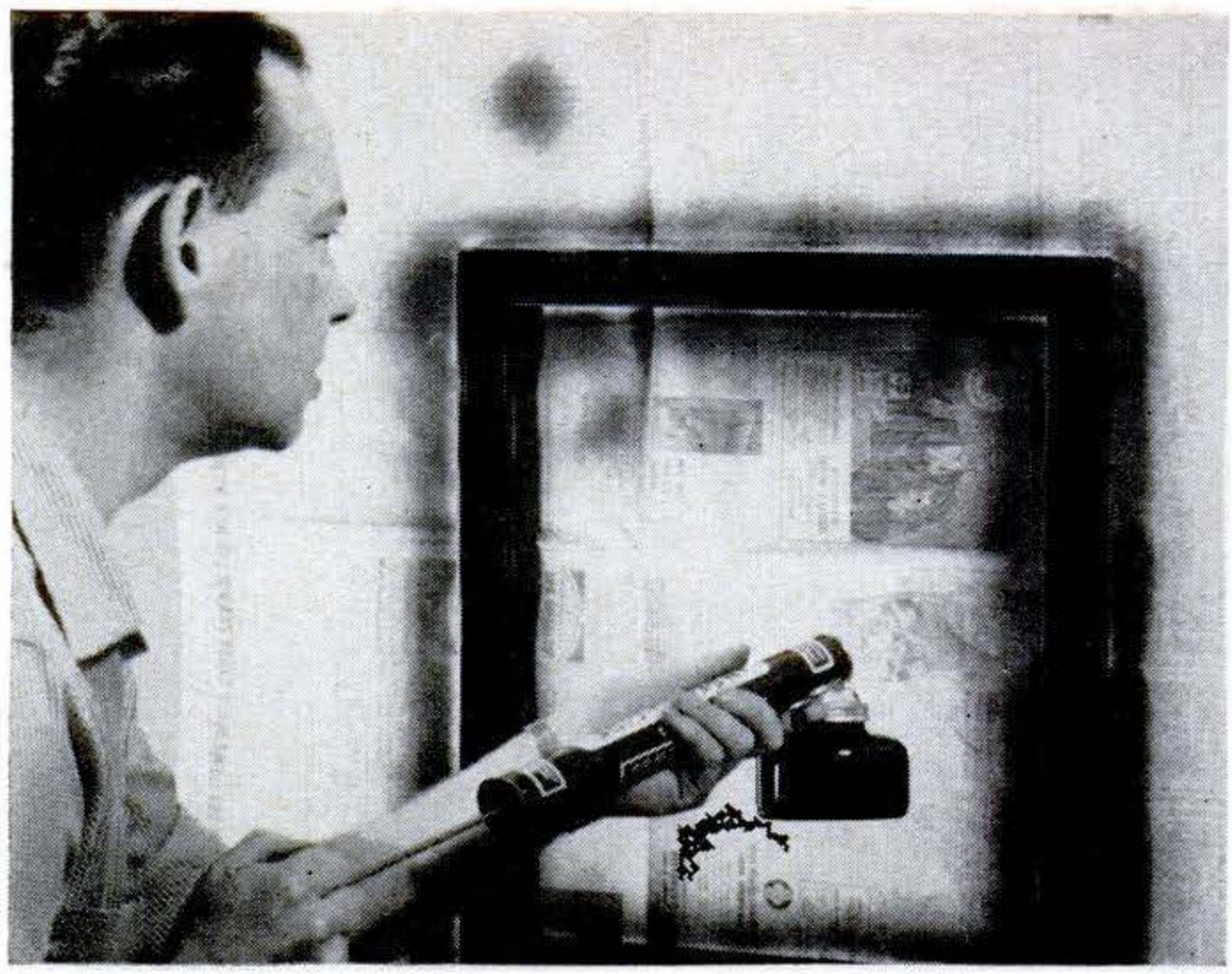
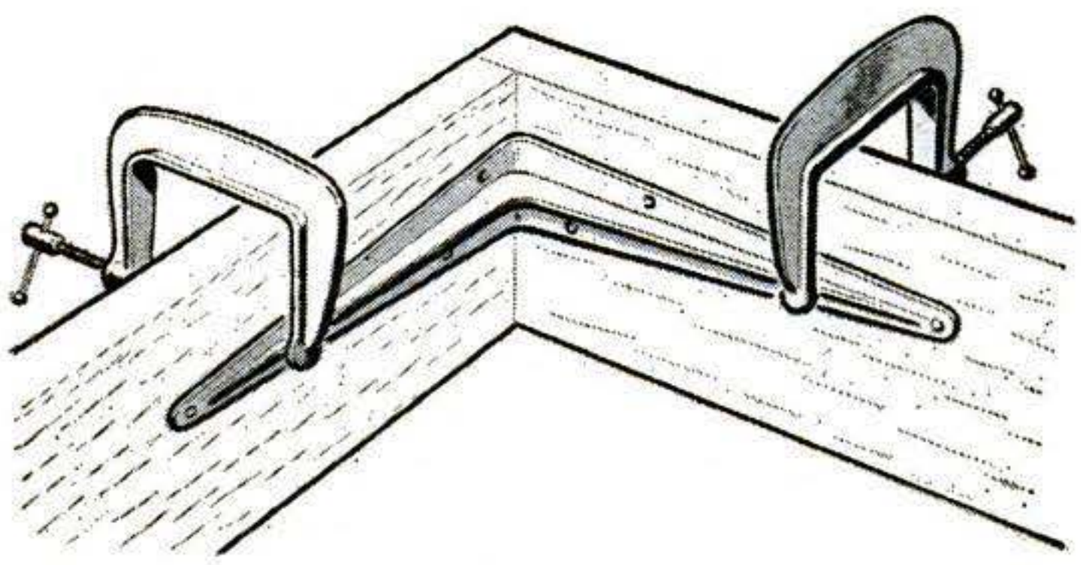
Short Cuts and Tips

Hand-Pump Sprayer Paints Small Jobs

IT'S worth remembering that a hand sprayer can be used as a spray gun for small painting jobs. Cut the paint half and half with thinner, and pump on several light coats. You'll get a smooth finish.—*John Burroughs, Tacoma, Wash.*





Bracket Makes Corner Clamp

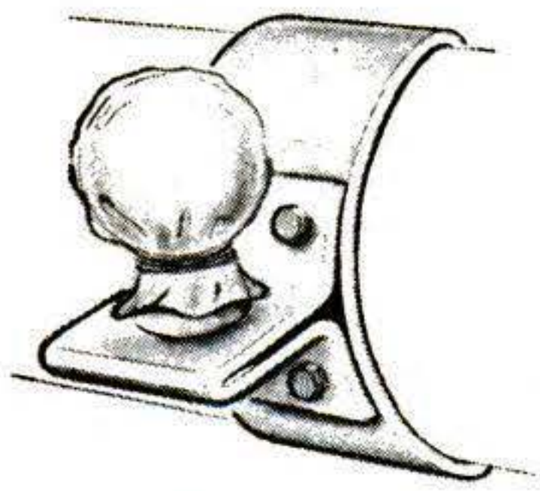
WITH a heavy-duty shelf bracket and two C clamps you can improvise a clamping jig for holding mitered or butt-jointed stock at a true 90-degree angle. Try it next time you're gluing up picture frames, drawers, screens, cornices or other trim. —*Norman Jacky, Fond du Lac, Wis.*

Tape Keeps Dirt out of Oil

I BUY my shop oil by the quart and open the can with a beer-can opener. To keep the oil free of dust and dirt after the can has been opened, I wipe off any oil on the top and seal the two triangular openings with pieces of masking tape.—*Hugh F. Williamson, Butte, Mont.*

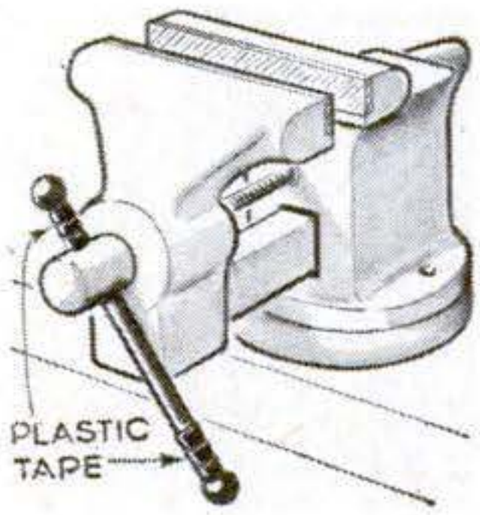
Plastic Bag Seals Trailer Hitch

I WORKED out a simple dodge for keeping the ball of my trailer hitch out of the weather. I cover it with one of those plastic bags in which carrots, beans and other vegetables are packed, then twist a rubber band around the neck of the bag to secure it. The waterproof sack makes a quick on-off cover, and there is always another one around if it gets damaged.—*John Krill, North Lima, Ohio.*



Guard on Vise Protects Fingers

VISE handle always sliding down to pinch your fingers? Wrap plastic tape around the handle just below the knobs. Then they won't be able to wham down unexpectedly on the vise screw.



▶▶▶When you find that the head of a hammer is loosening, soak the tool in a pail of water overnight. Expansion of the wood will make the handle tight again.

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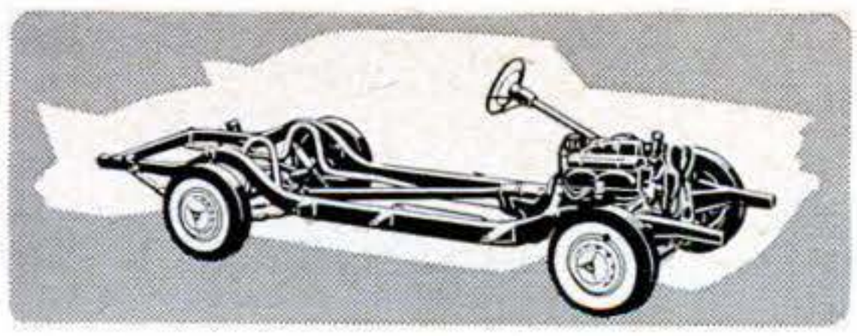
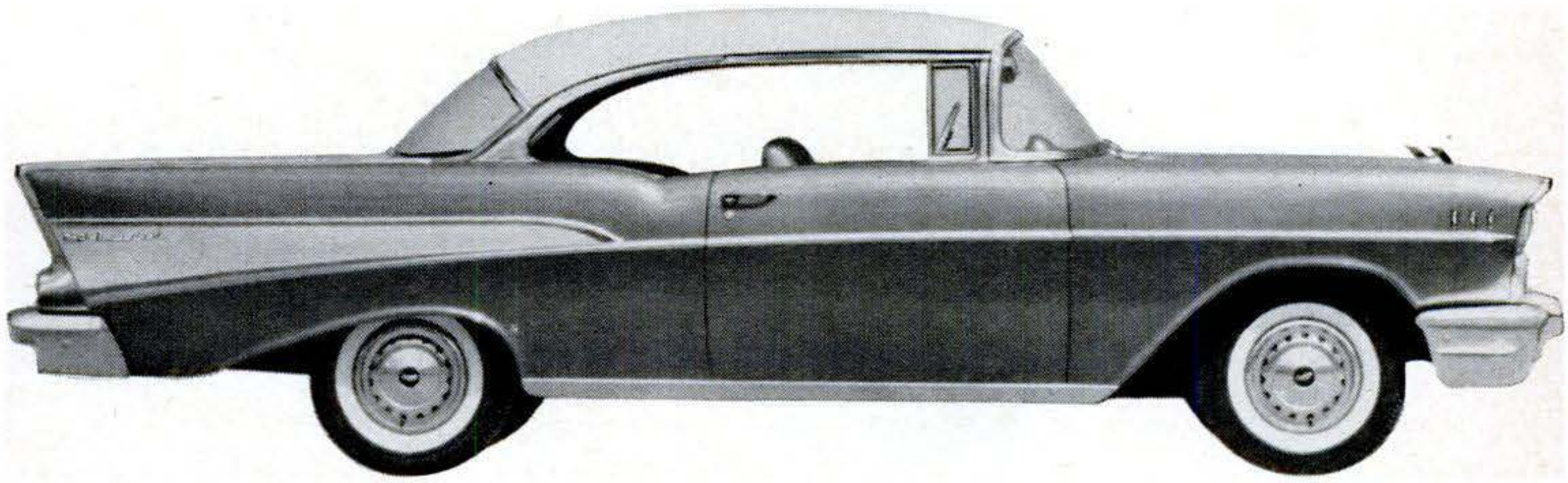
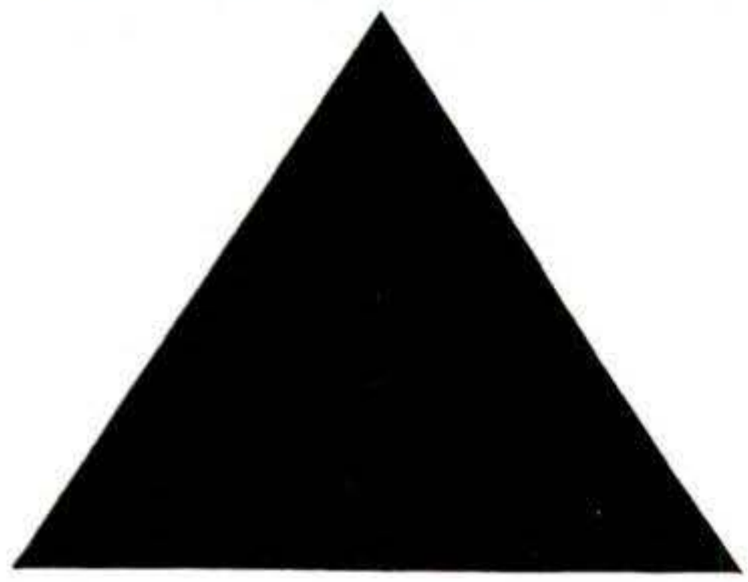


X-RAY ON CHEVROLET



HOW DO YOU BUILD IN BALANCE?



Fifty-fifty weight distribution is the automobile designer's aim—and his nightmare! It's easy to understand why: Balancing the weight equally between front and rear wheels is fundamental if you want stability and sure-footed control on curves and solid driving traction at the rear. But (and this is the joker) the passenger space has to be *ahead* of the rear axle if you want a soft rear seat ride and full rear seat hip room.

On most cars, that means too much weight on the front wheels. But not in Chevrolets. For example, a Chevrolet "Two-Ten" four-door sedan with Turboglide has from 207 to 240 pounds *less* dead weight on the front end than comparable cars in the low-price field.

That makes a big difference in handling ease and road security. It explains why Chevy's steering is so light and precise, why its traction is better (light rear ends tend to spin and skid under power thrust). It is the basic engineering principle behind Chevrolet's famous roadability. It is a basic design fact that can be proved *on the scales*. But there's an easier proof for you—just see your dealer and drive a new Chevrolet. You'll find there's a whale of a lot more pleasure in bossing the best balanced car in its field! . . . Chevrolet Division of General Motors, Detroit 2, Michigan.

CHEVROLET

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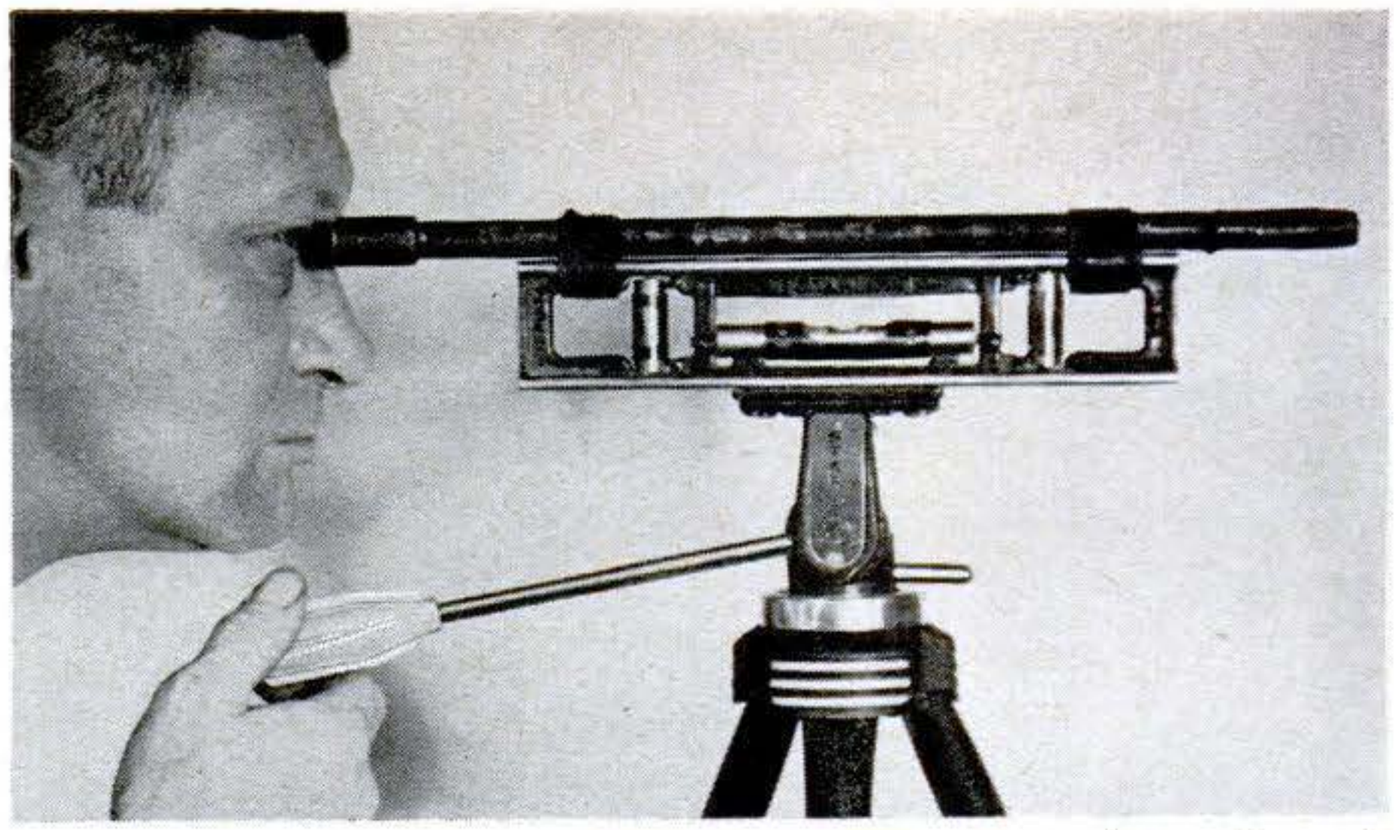
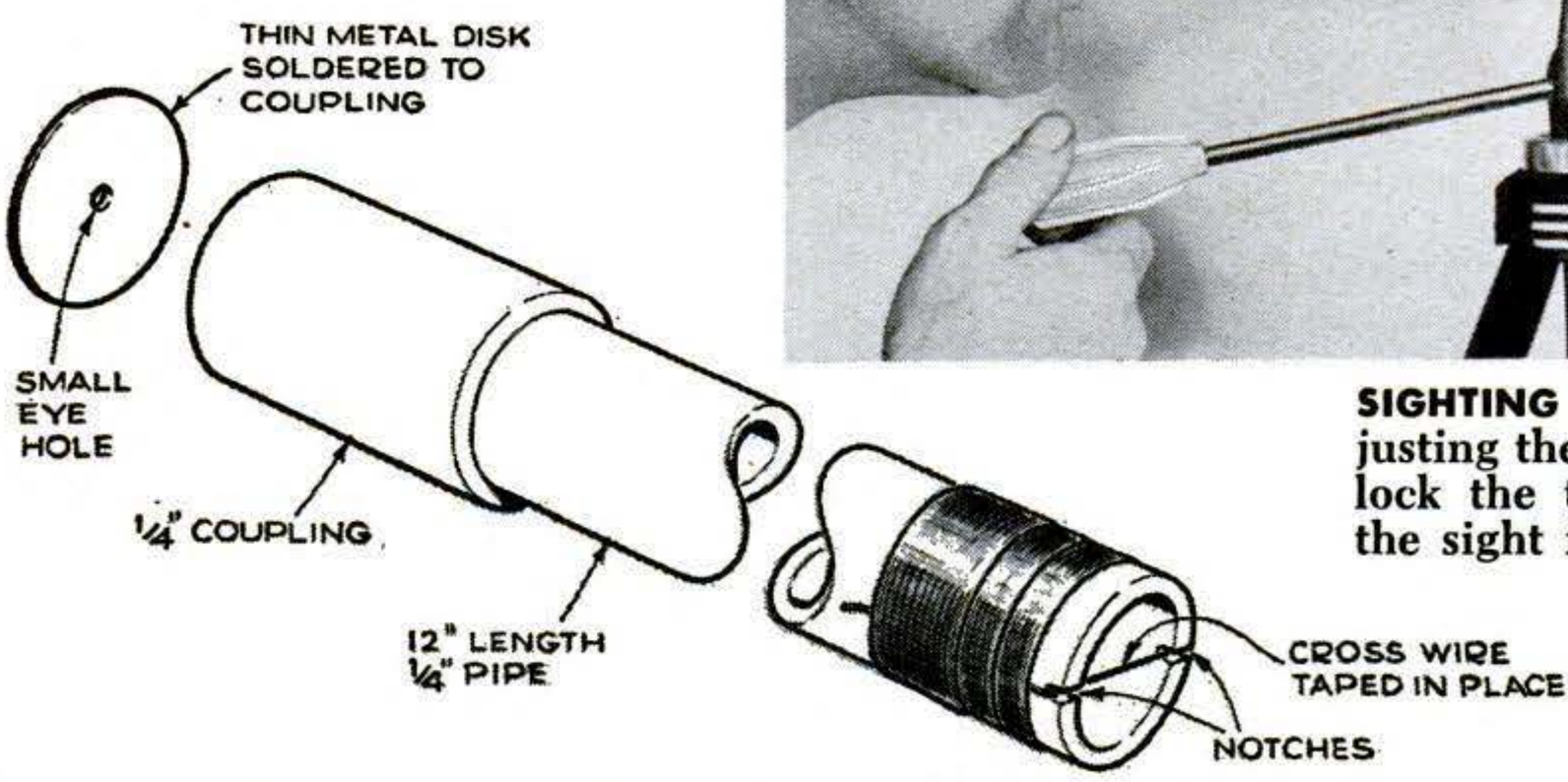
Short Cuts and Tips





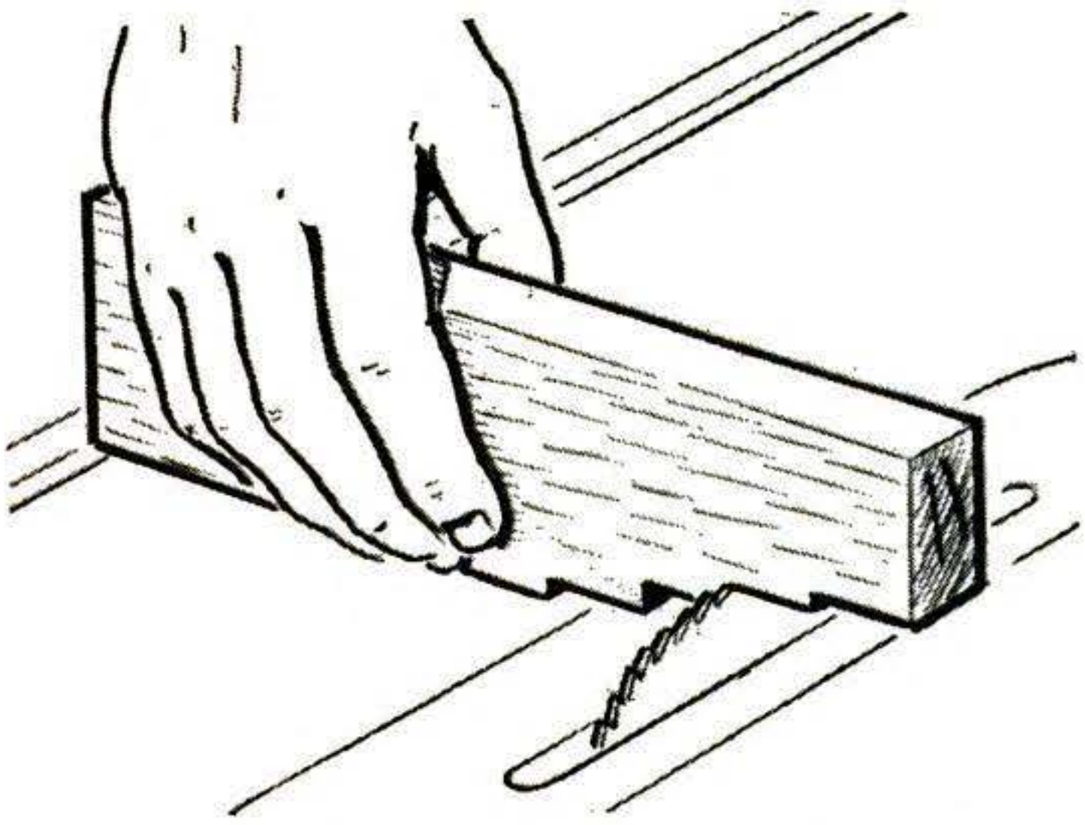
SIGHTING TUBE IS LEVELED by adjusting the tripod legs. Then you can lock the tilt adjustment and swing the sight in a full 360° circle.

Hand Level Mounted on Camera Tripod Surveys Home Jobs

You can set fence posts to uniform height, grade a back yard or lay out a foundation accurately with a bubble level and a camera tripod.

Drill and tap a ¼"-20 thread in one edge of the level for the tripod screw. Make a sighting tube from a 12" length of ¼" pipe and fit it with a cross wire at one end and a peephole at the other. Tape the tube to the top edge of the level with the cross wire horizontal.

Screw the level to the tripod, then adjust the legs and pan head so that the bubble centers when the head is swiveled in all directions. By sighting through the tube at a marked pole, you can get comparative levels at different points.—*J. P. Marshall, Barrington, R. I.*



Stepped Block Gauges Saw Cut

A piece of hardwood stepped as shown will eliminate the need for a rule every time you want to set the depth of cut on a table saw. Cut the notches accurately for commonly used rabbet dimensions and mark each to show fractions of an inch. Drill a hole in one end of the block, and you will be able to hang it up near the saw.—*Victor H. Lamoy, Upper Jay, N. Y.*

▶▶▶Before painting a new concrete-block wall, it is standard practice to let the wall dry for at least six months. But you can skip this waiting period if you neutralize the surface with a wash coat of zinc sulfate dissolved in water. After applying the solution, let the surface dry and follow up with a stiff-brush cleaning.

Spatter Stopper

After soaking a paintbrush to clean it, shaking out the last of the solvent scatters droplets all over. By observing a housewife cleaning dust from a mop, I learned how to get around this nuisance. Now I just enclose the brush in a paper bag before I start waving it around to get the solvent off.—*R. T. Kimball, Salt Lake City.*

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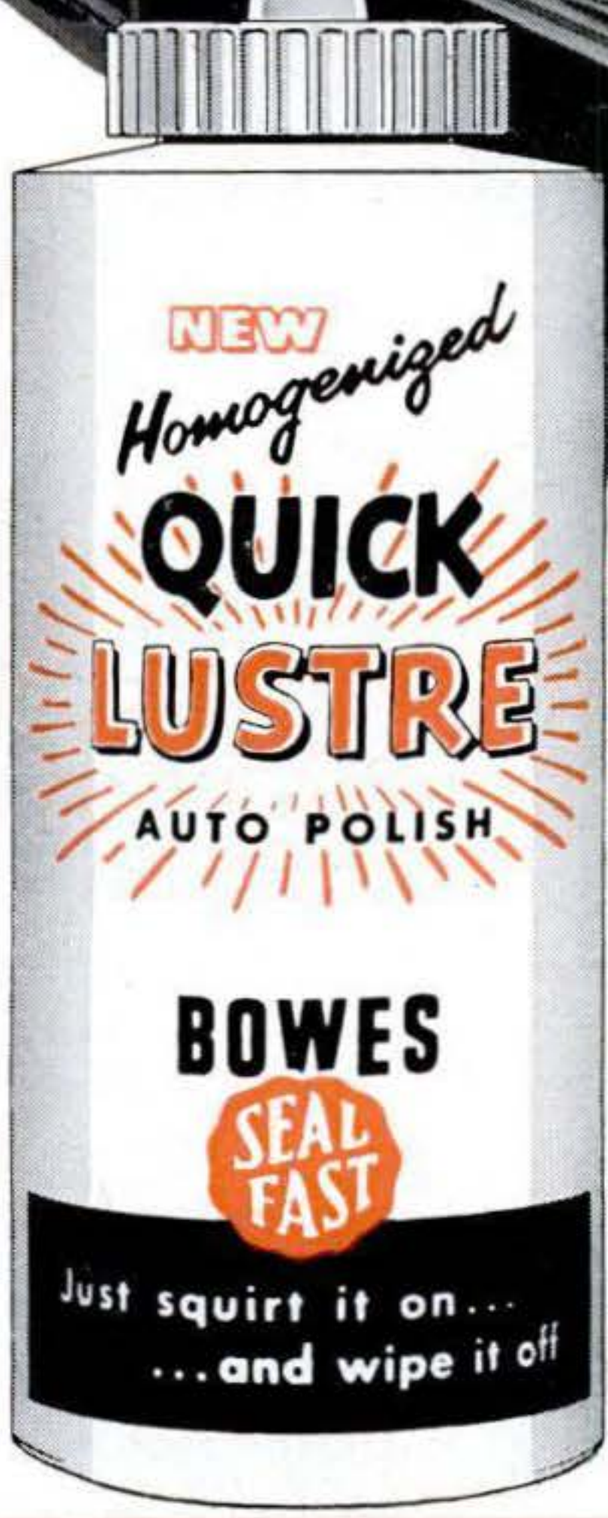

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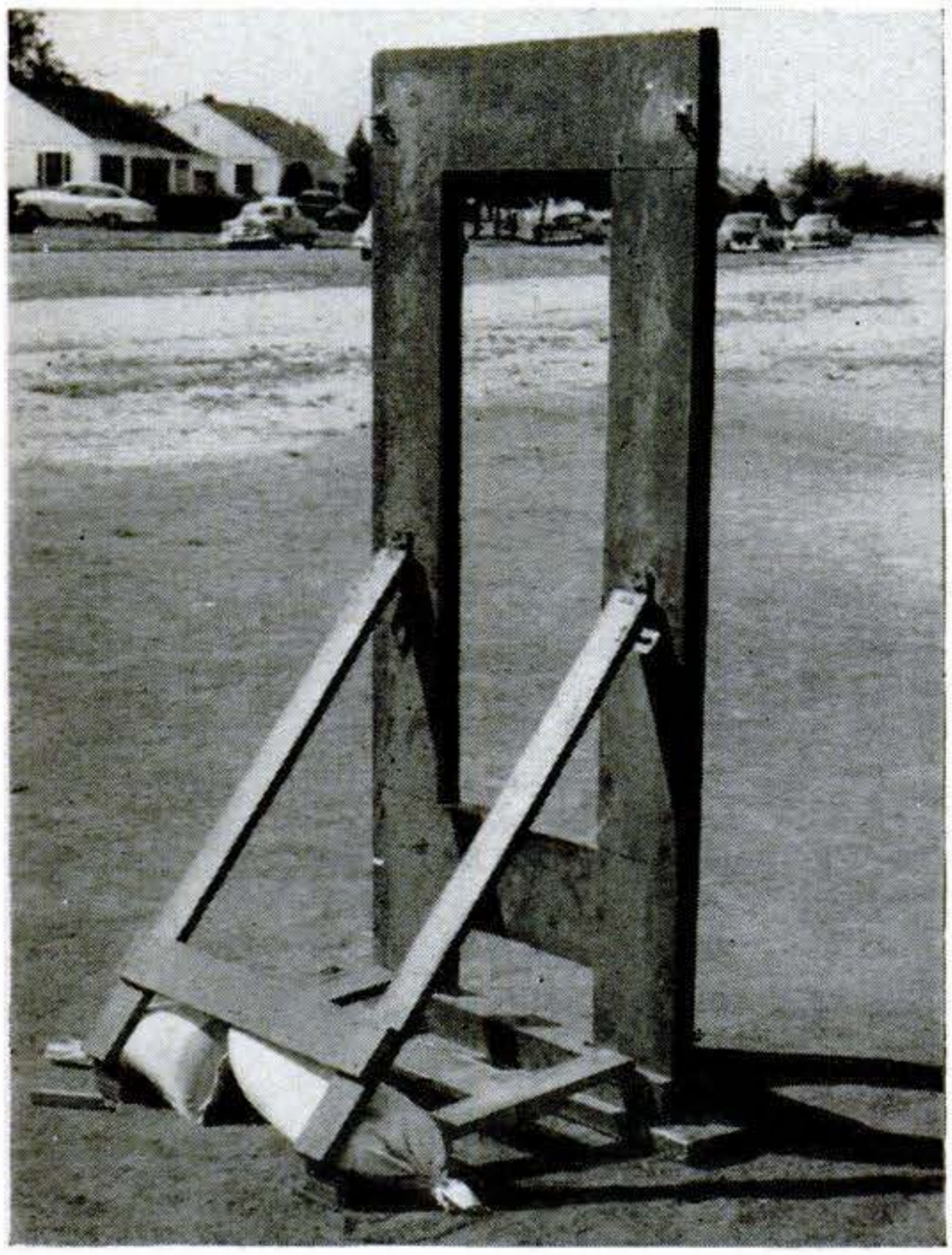
Short Cuts and Tips

Cans Spot Tent Pegs

To PREVENT stumbling over tent stakes when you are camping, up-end an empty can over each one.

Shiny imprinted cans or ordinary cans with the labels stripped off will gleam in the sun or moonlight even though they're partly covered by grass.—*Norm Jacky, Fond du Lac, Wis.*



Ball Target Aids Rookie Pitcher

THIS strike-zone frame can help a young pitcher gain control over wildness. It gives him an opening 17″ by 42″ to throw at, with the bottom edge of the opening 18″ above ground level.

It can be built of any tough 1″ wood. Hinged legs at the back support it and allow it to be folded flat for storage. Sandbag weights can be used to make it more solid.—*J. R. Clawson, Wichita, Kan.*

Electricity Runs Gas Mower

WITH a secondhand 1/3-hp. motor and 100′ of three-wire grounded cord, I converted my worn-out gasoline mower to an electric job. I took off the old engine, drilled holes in the cover plate of the mower to match those in the electric motor's baseplate and bolted them together. A belt pulley hooks up mower and motor, and the switch is on the handle. —*Dr. R. F. Perkins, Tonawanda, N.Y.*

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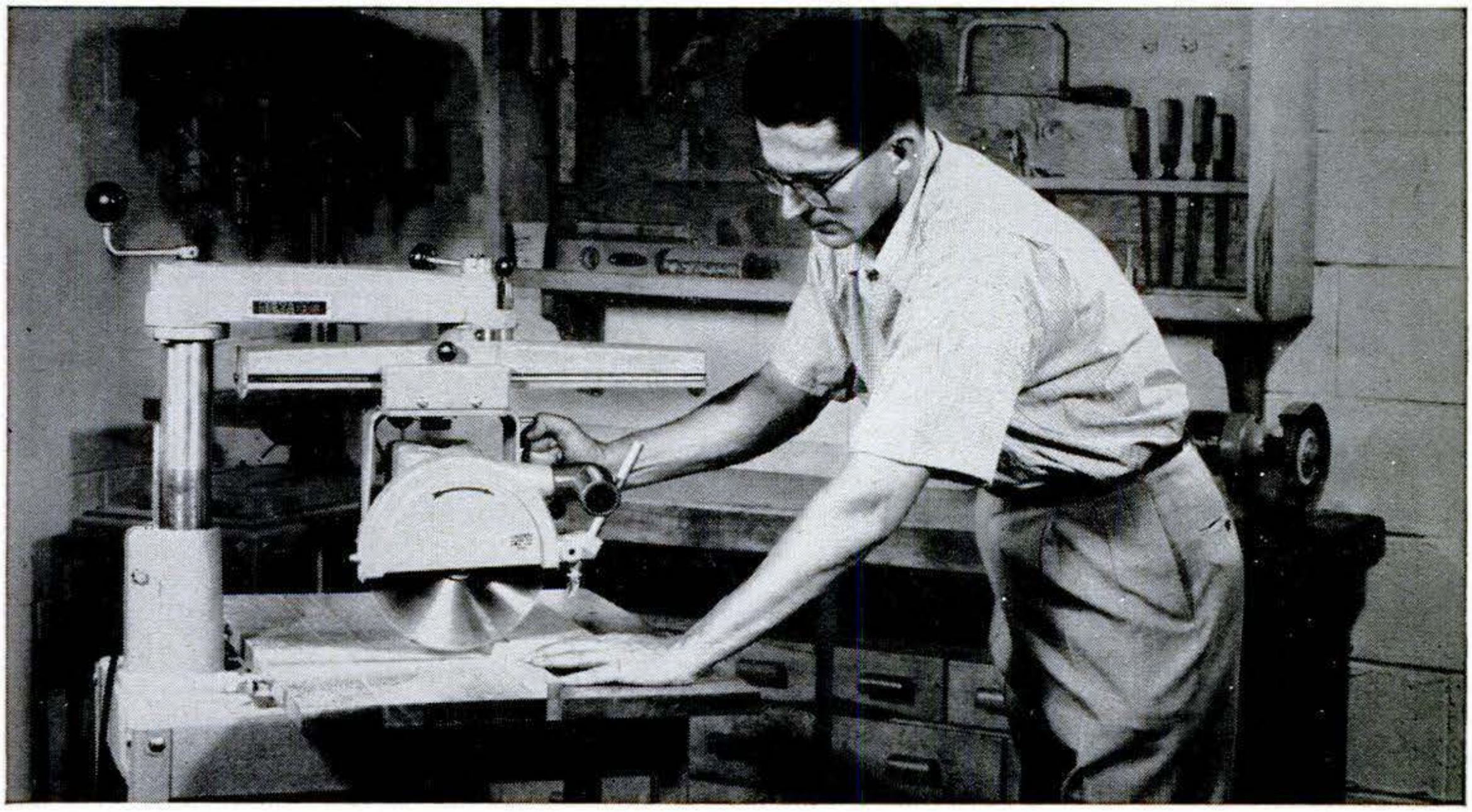
ROCKWELL-BUILT

DELTA "900" radial saw



...."industrial saw" power, home workshop price

The Delta "900" is the most powerful 9" home workshop radial saw ever built. And it's the most useful all-purpose radial saw ever made for use outside of industry. Here's why:

TRUE ¾ H.P. MOTOR—Actually exceeds NEMA power specifications. Guaranteed for one full year! You make heavy cuts faster, easier—and the motor runs cooler.

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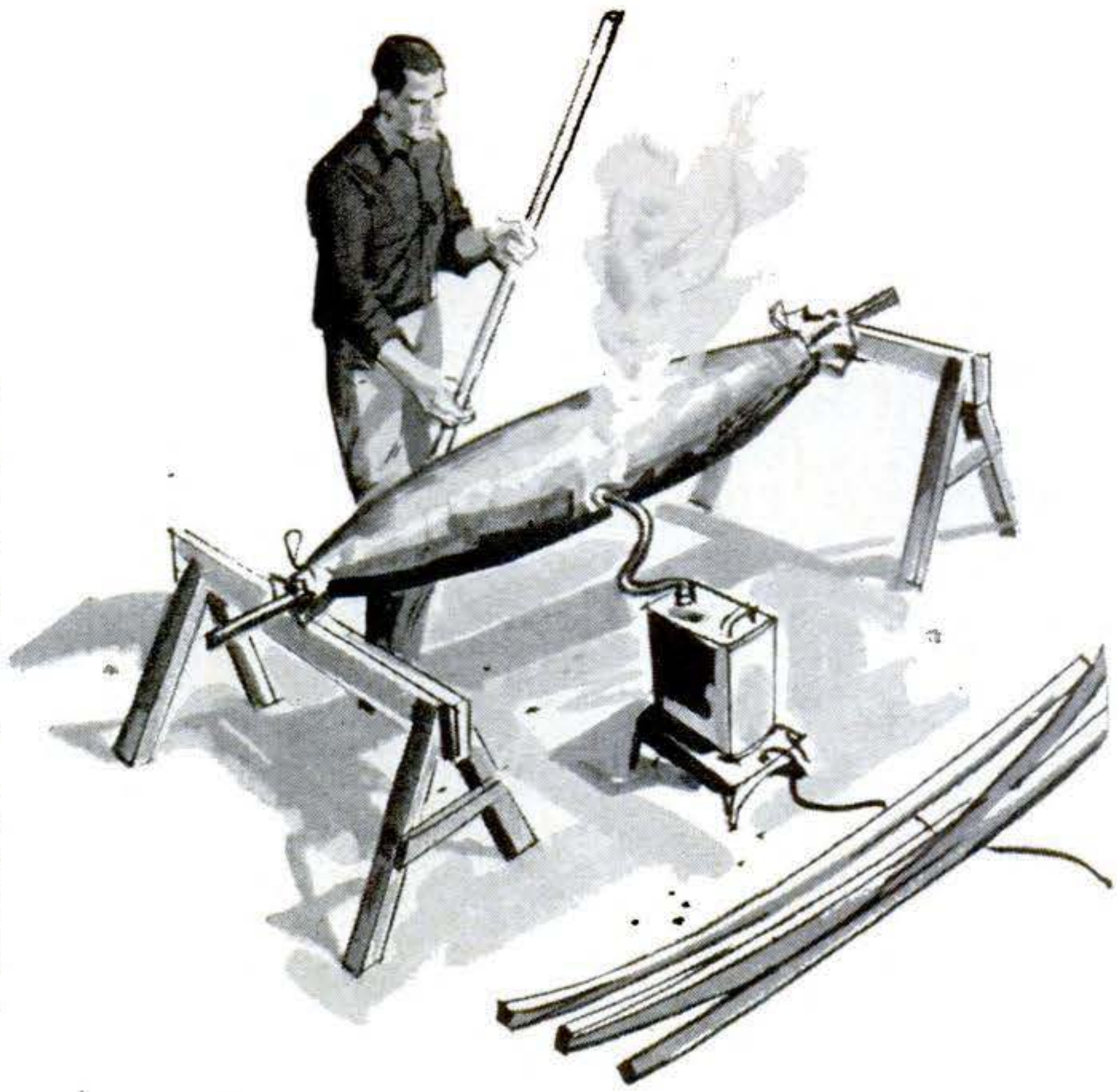
Short Cuts and Tips

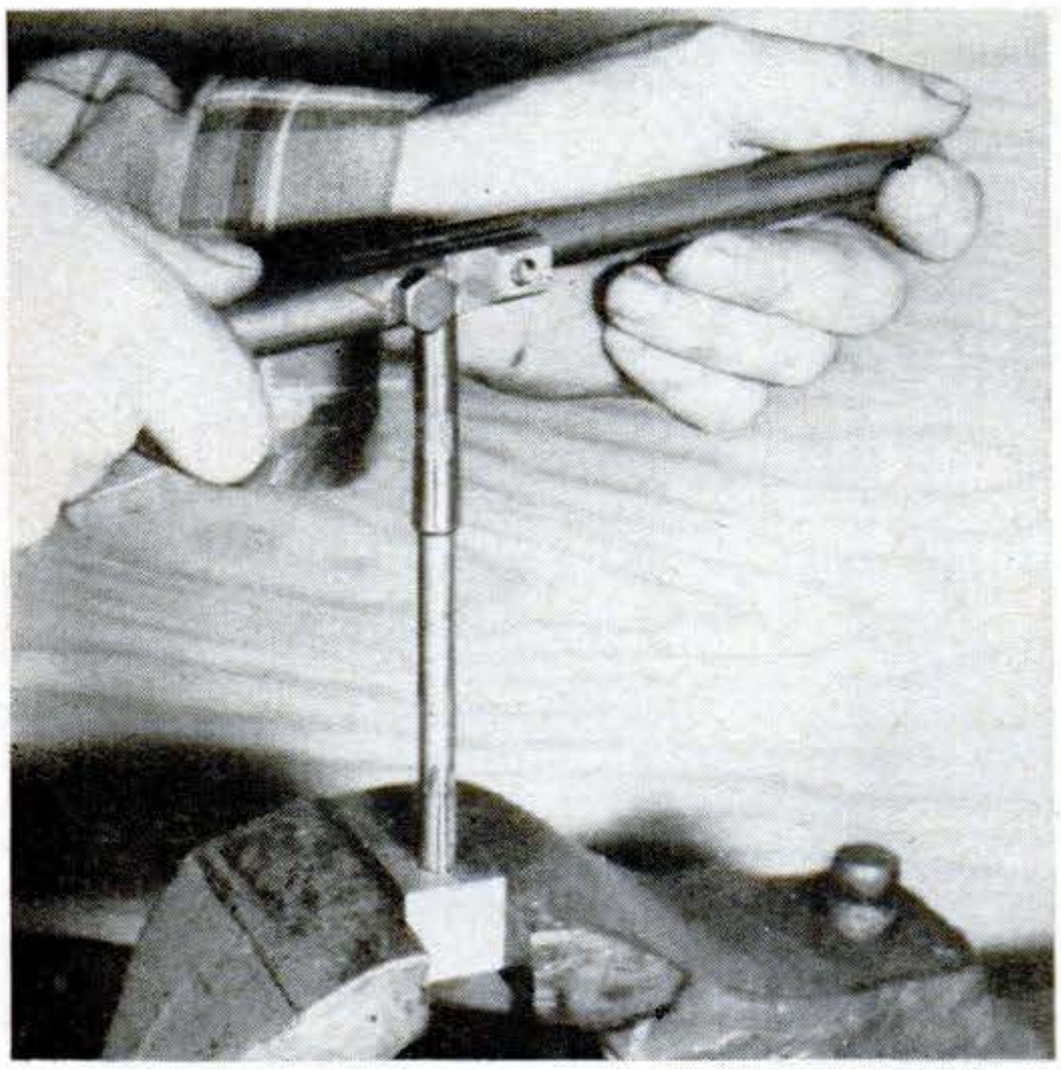
Steam Aids Boatbuilder

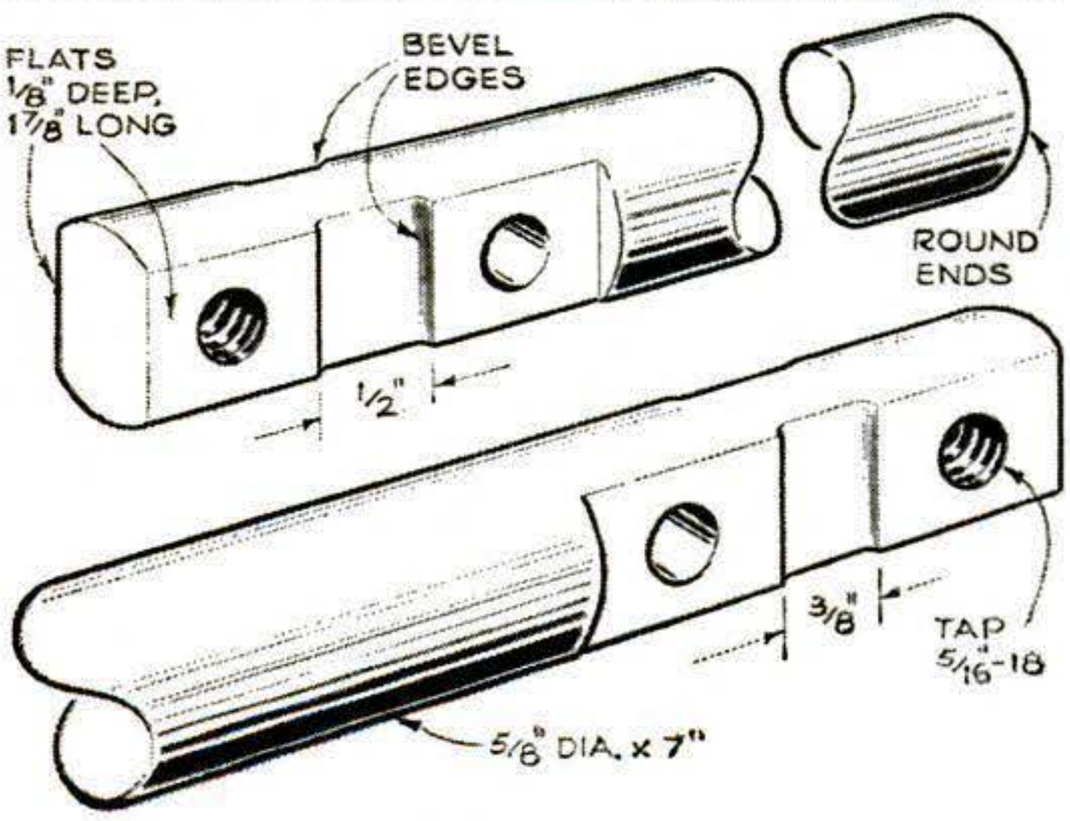
WHEN I started my second boat, I improvised a steamer to soften the hardwood for bending, using a truck-size inner tube cut apart opposite the valve stem.

The wood is inserted, the tube ends are tied with wire, and a hose is slipped over the valve stem. Steam swirls through the hose from a can of water that is heated by a hot plate or blowtorch.—*Dr. Richard Lund, Salt Lake City.*



Handle Adapts Taper-Shank Lathe Reamer for Reaming by Hand



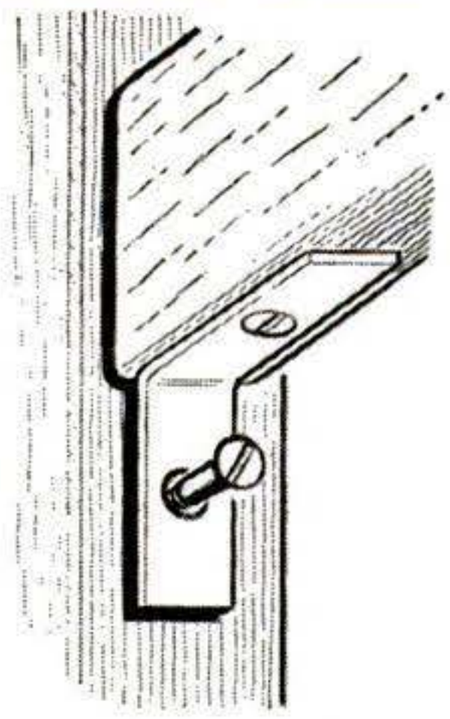


CLAMP a machine reamer in a handle like this and you can use it for hand reaming. To make it, file or mill opposite flats on each of two pieces of 5/8" bar. Clamp them with two flats touching, and run a No. F drill through both to cut two holes 1 1/8" apart. Tap through the end hole in each bar; open the others to 5/16".

File 3/32"-deep notches between the holes, one 3/8" wide to take No. 1 shanks, one 1/2" wide to take No. 2 shanks. Clamp reamers into the handle with 1" hex bolts. —*Carleton A. Phillips, Corning, N. Y.*

Angle Irons Tighten Loose Chair

A WOBBLY chair with the seat frame tenons loose in the leg mortises can be tightened with small angle irons. Screw the brace to the frame of the seat first; then turn the second screw until it draws the parts snugly together. —*Frank Shore. NYC.*



▶▶▶ If bending the float rod in a toilet tank won't stop a continuous leak, try reducing pressure at the shutoff valve. Close the valve and reopen it part way.

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Envy of the pros, and of the neighbors, too!

New Plymouth with the 290-hp FURY V-800 mill!

On every big strip in the country professional competition drivers are taking their hats off to new Plymouths powered by the new FURY V-800's. And when a new Plymouth is on the street (for example, in front of *your* house) the neighbors really sit up and turn green!

You can get the 290-hp FURY V-800 (twin pots, big heads, high lift cams, and other extras) in *any* Plymouth model, even the lowest priced. And the Plymouth is built to *handle* this power, with lower center of gravity, racing-type torsion bars and ball-joint construction up front, binders that won't fade no matter how often you hit them.

You'll herd this jewel on the strip with pride in its performance . . . drive to church or a date with pride in its style! **See your dealer and drive a Plymouth soon!**

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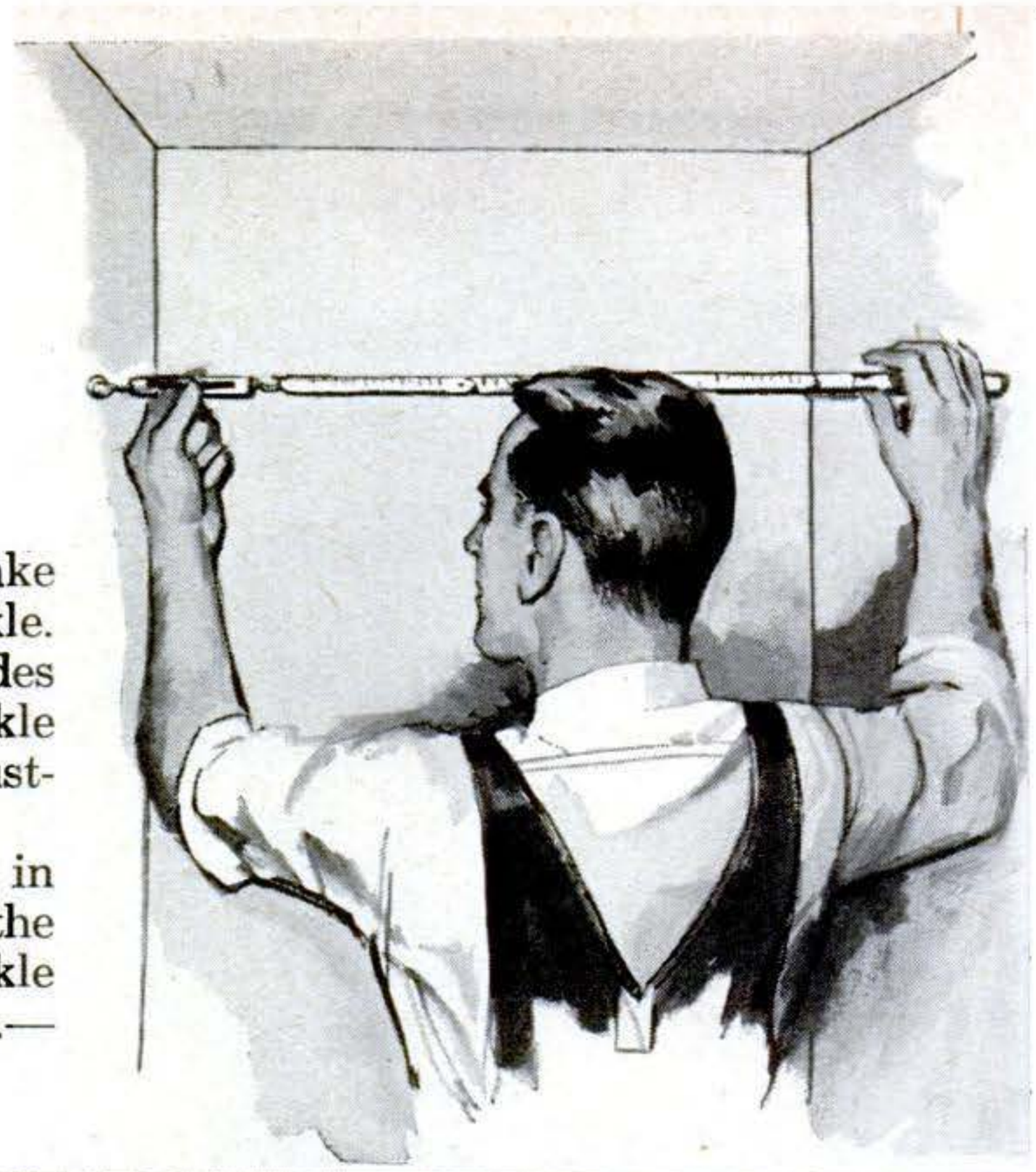
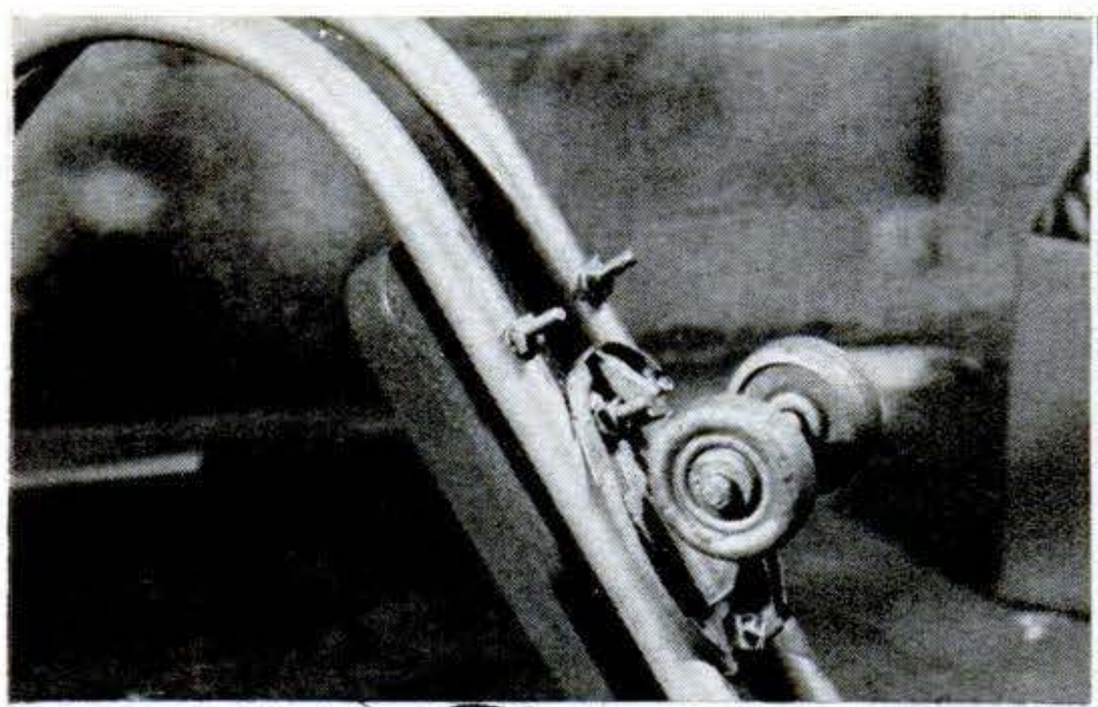
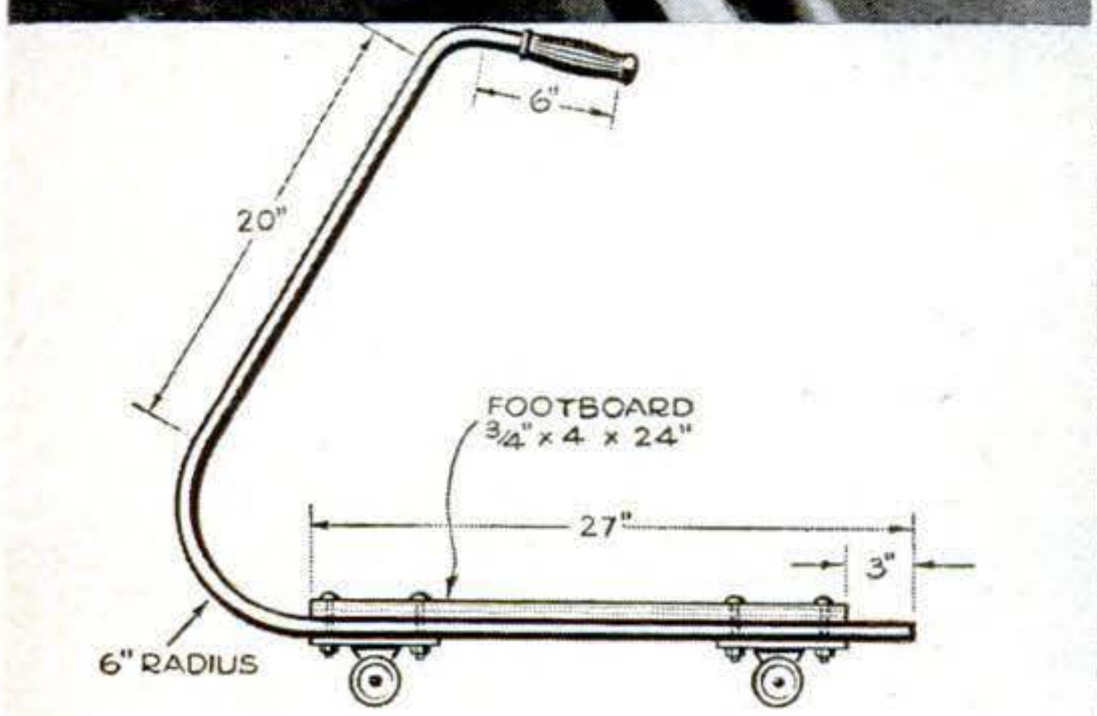


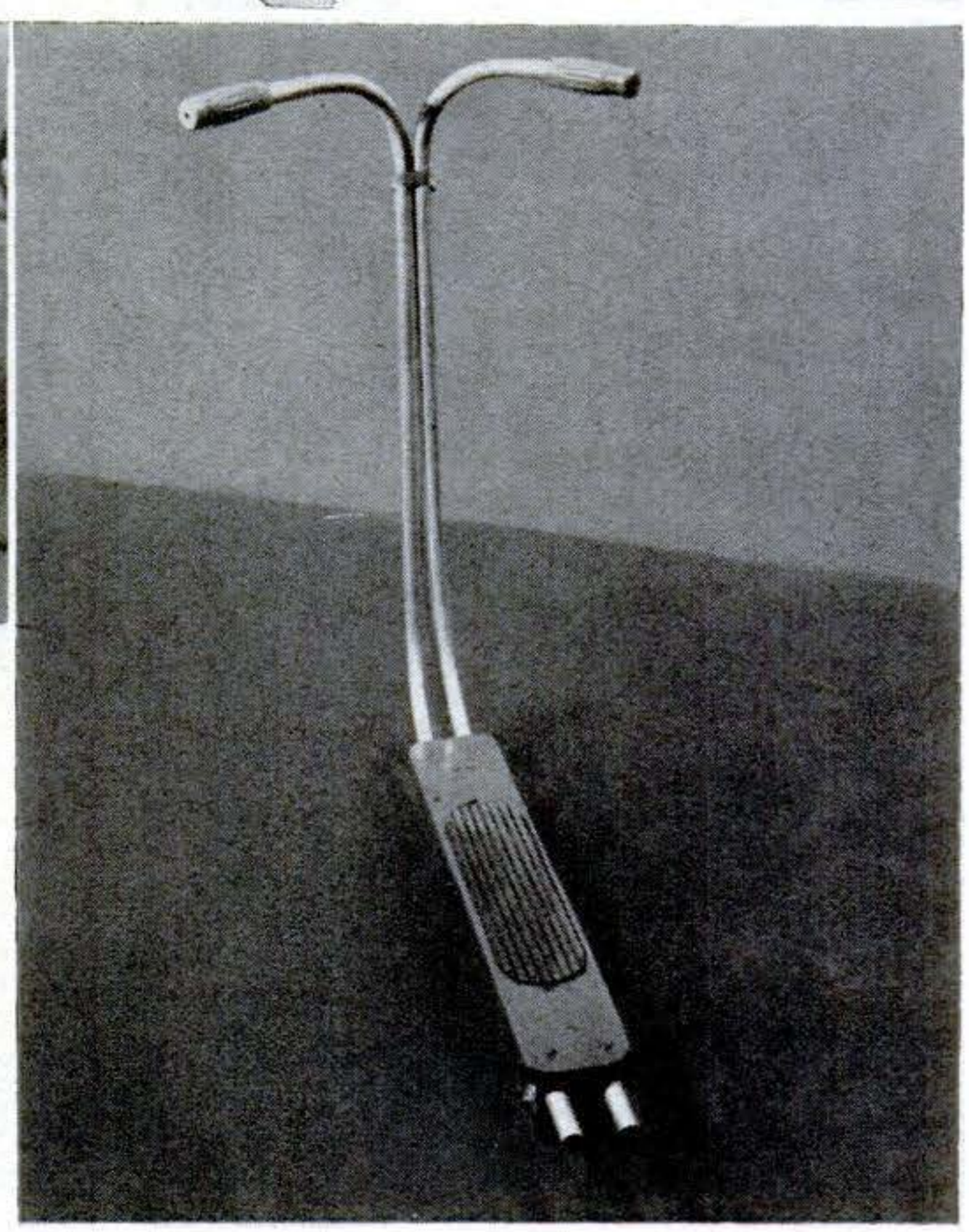
Turnbuckle Used as Calipers

IF CALIPERS aren't handy, you can take an inside dimension with a turnbuckle. Extend the screws to touch the two sides of the opening, remove the turnbuckle carefully so as not to disturb the adjustment, and measure its overall length.

For large dimensions, as for a shelf in a closet, use a folding rule opened to the nearest length, and adjust the turnbuckle so that it will fill the remaining space.—*Bruce D. Stewart, Winder, Ga.*







Streamlined Scooter Made of Tubing Has Dual Exhaust Pipes

Two dollars' worth of tubing and an old roller skate can be turned into a snappy streamlined scooter.

Bend two 6′ lengths of thin-wall conduit or aluminum tubing to form the frame and handle bars. Borrow a conduit bender from an electrician, or pack the tubing with sand to avoid kinking. Bolt the tubes together just below the handlebar bend, spread them 2″ apart at the bottom, and fasten the footboard to them with 3/16″-by-1¾″ bolts. Use lock washers to keep the nuts from loosening.

Remove the shoe clamps and heel plate from the skate and separate the halves. Drill two holes in the center of each and fasten them to the footboard with ¼″-by-2″ bolts. Cement a rubber mat to the board and slip rubber grips over the handle bars.—*Ron Anderson, Minneapolis.*

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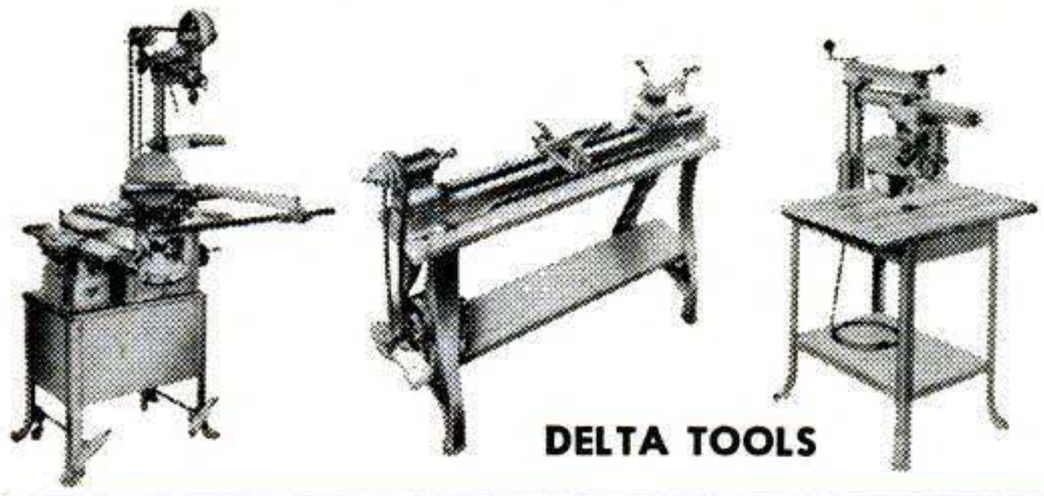

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SECOND PRIZE is $450 worth of tools and $250 worth of Weldwood products.

5 THIRD PRIZES—each one is over $270 of tools *plus* $50 of Weldwood products.

140 MORE PRIZES of Black & Decker, and Stanley tools and Weldwood products!

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(If your dealer does not have entry blanks available, write to Old Craftsman, c/o United States Plywood Corp., 55 West 44th Street, N. Y. 36, N. Y.)

LOOK FOR THIS LABEL ON EVERY PANEL

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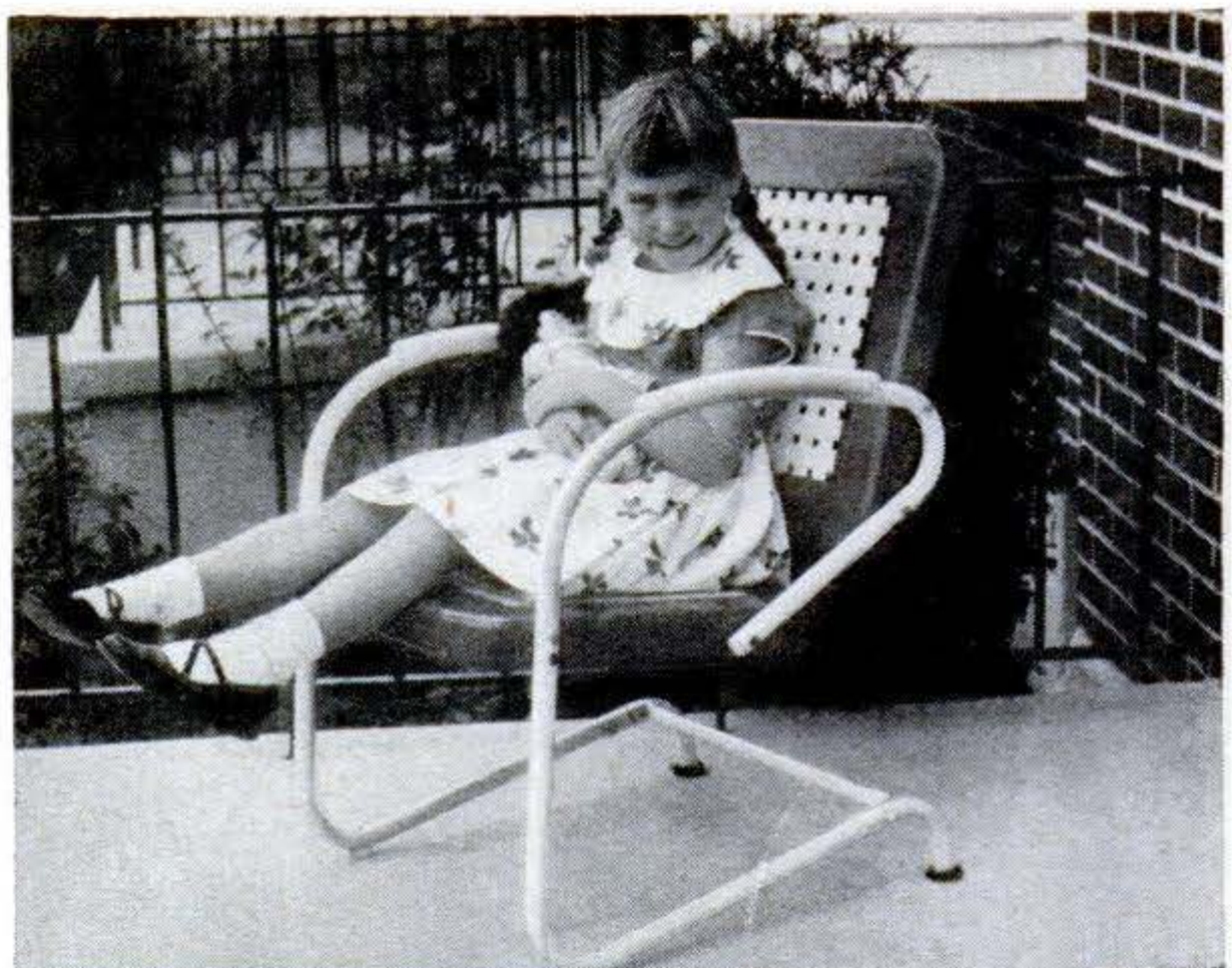
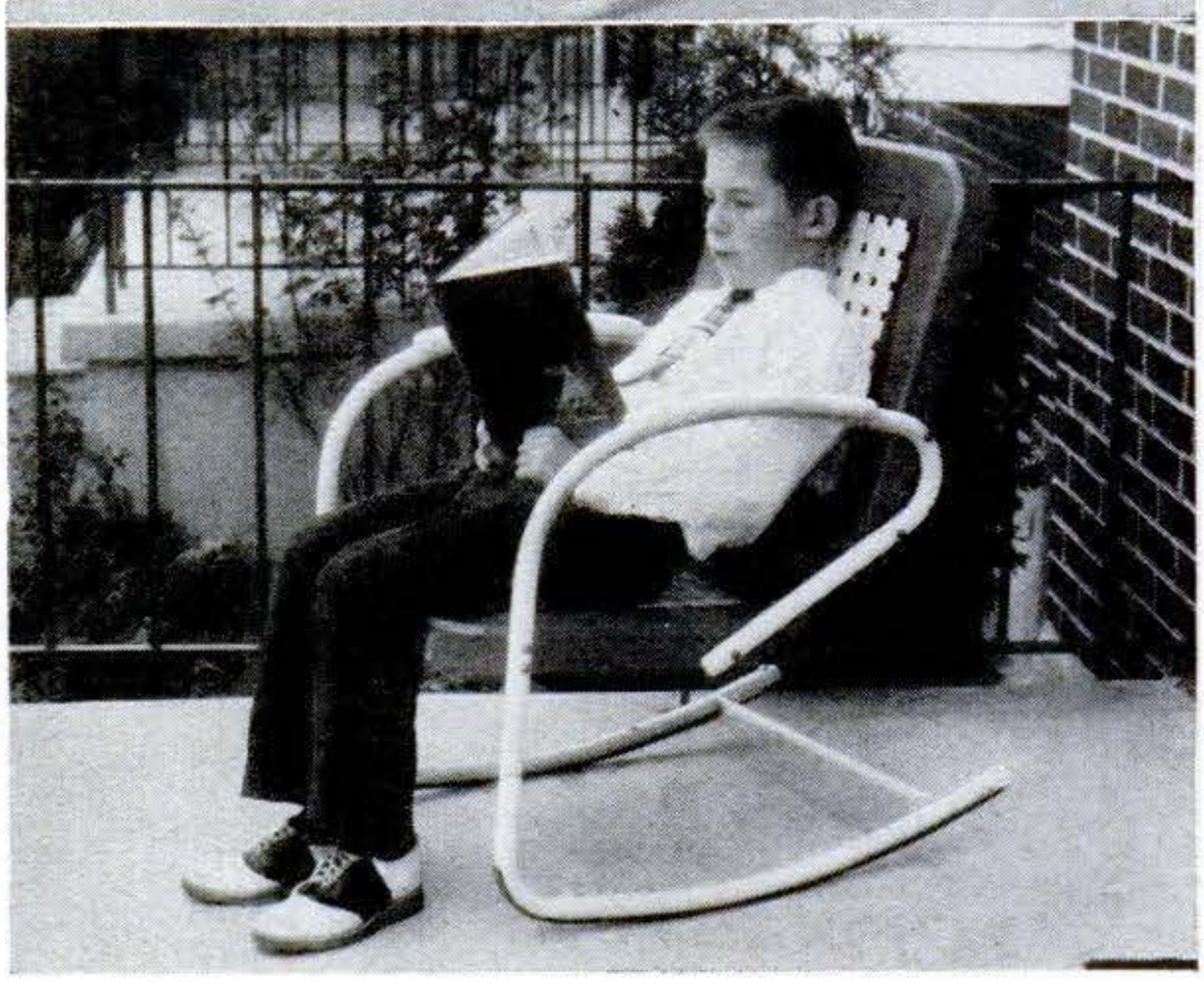
Short Cuts and Tips

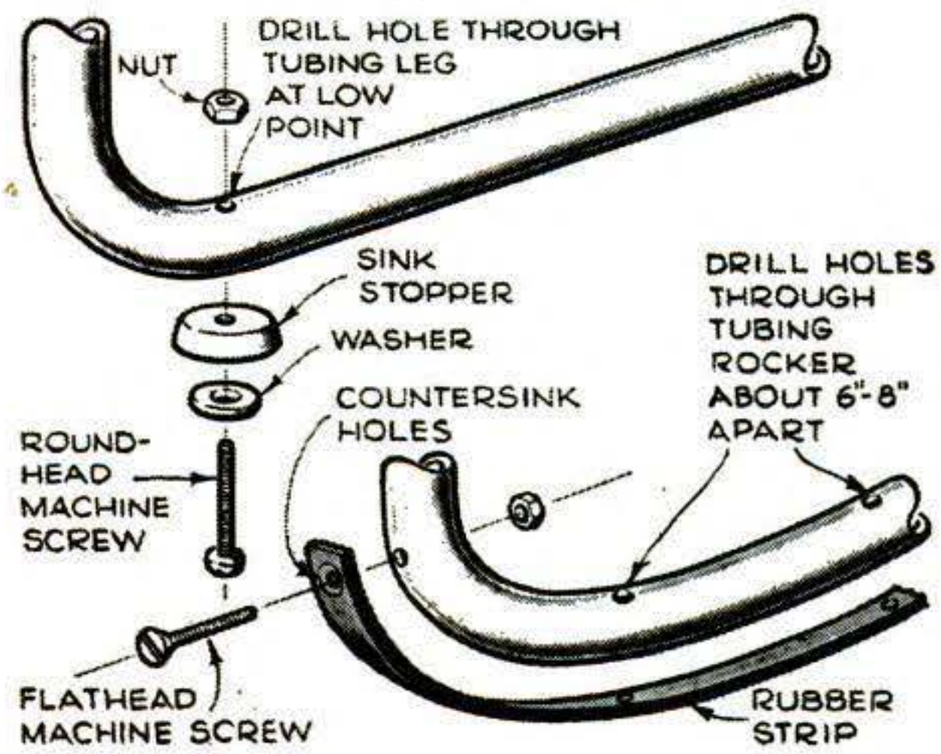
Pads Protect Cement Floor

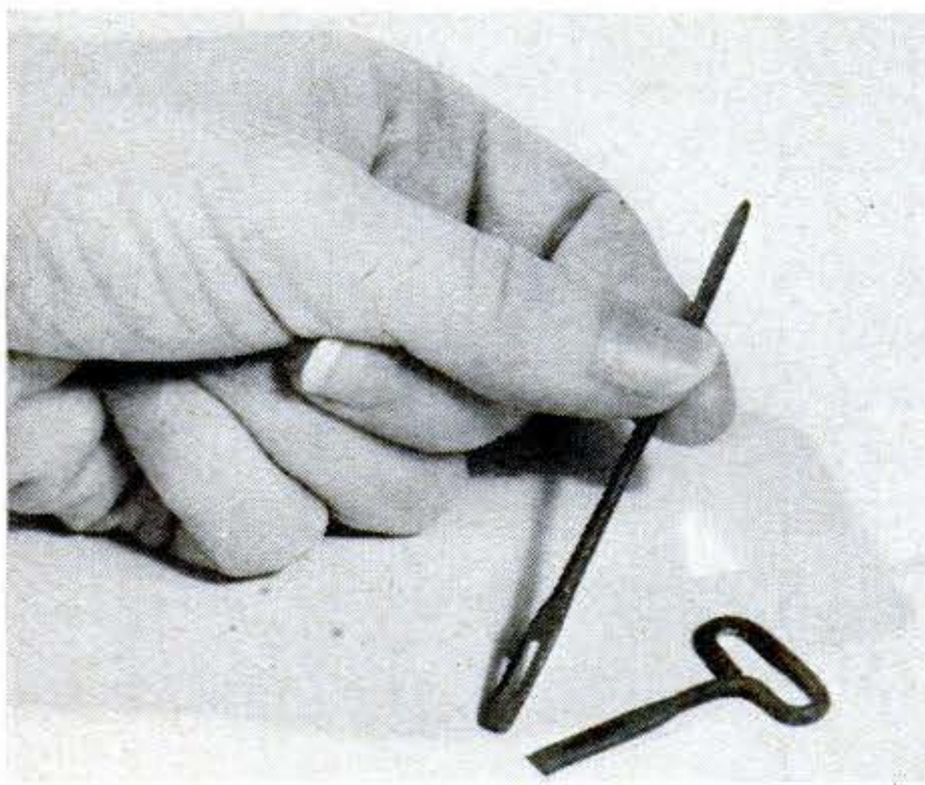
IF PAINTED tubular furniture rubs bare at the point of contact, cement floors and patios may be stained with rust. To stop this, lift the base on two sink stoppers. Remove the lugs, drill a hole through the center of each stopper and bolt one to each side of the chair.

Rockers (lower right) can be fitted with strips of rubber cut from tubing and screwed in place. —*John Voelker, Towson, Md.*



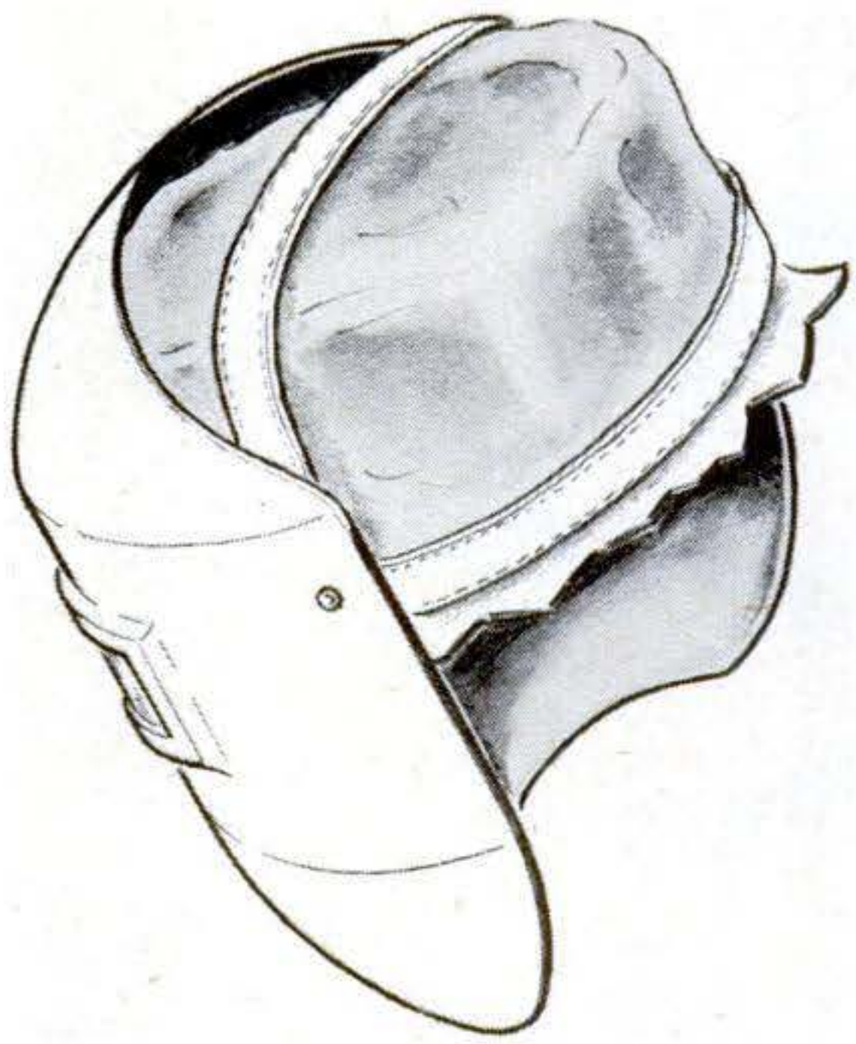






Can Key Is Heavy-Duty Needle

IF YOU need a sturdy needle for sewing heavy stuff like burlap tarps or feed bags, straighten out the handle of a key-type can opener and file this end to a point. Round off the corners at the slotted end and, with a needle file, round out the "eye."—*Frank A. Havens, Elizabeth, N.J.*



Cap Cushions Welding Helmet

TO MAKE a welding helmet a lot more comfortable, stitch an old cap, or the crown of a felt hat, to the headbands.

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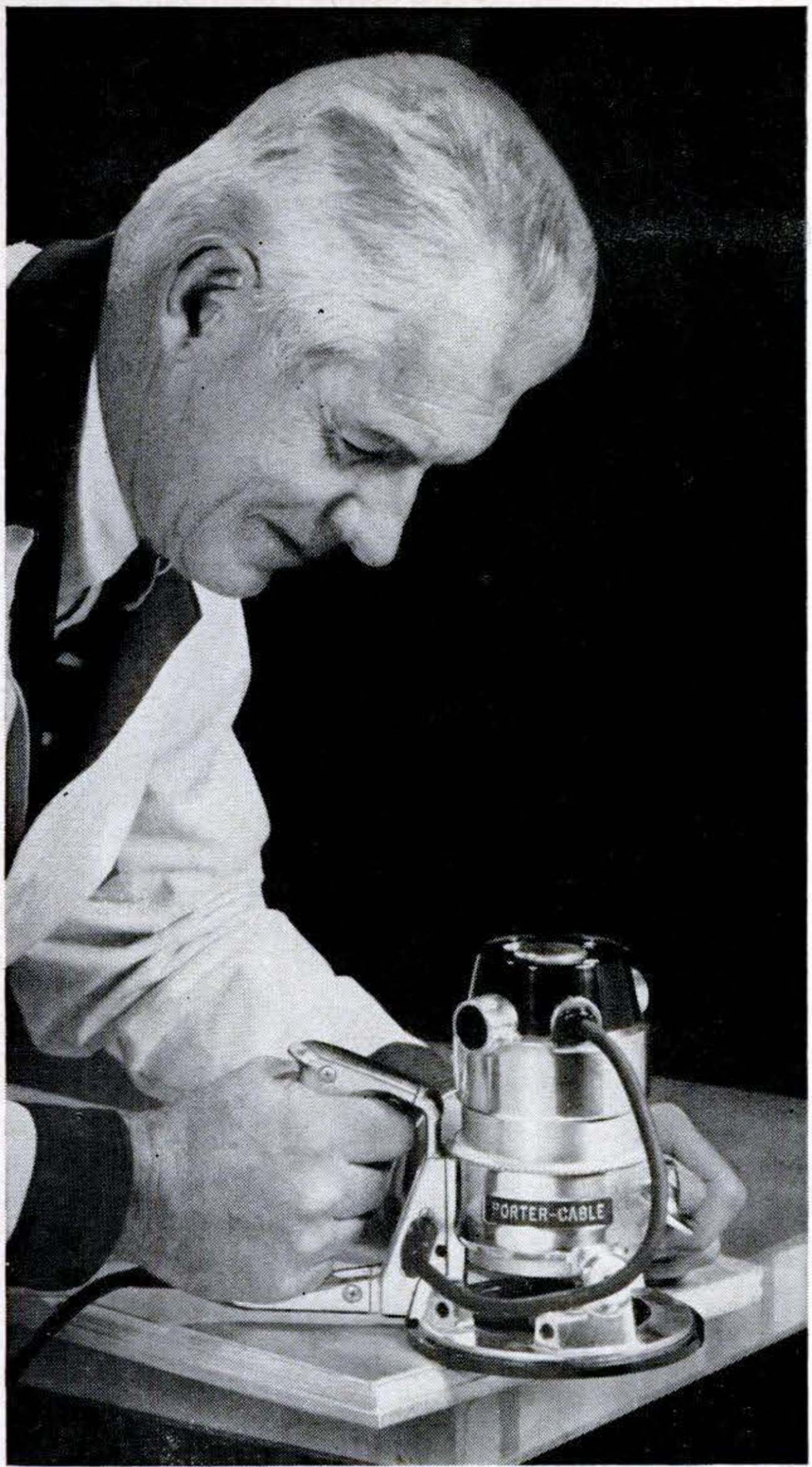

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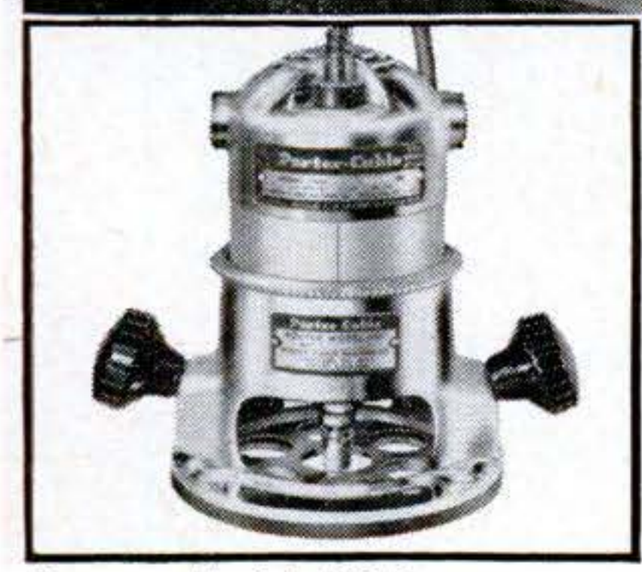

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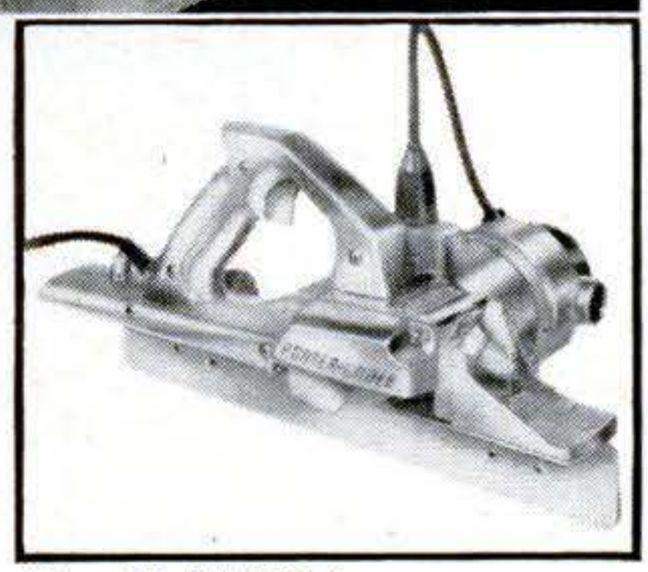

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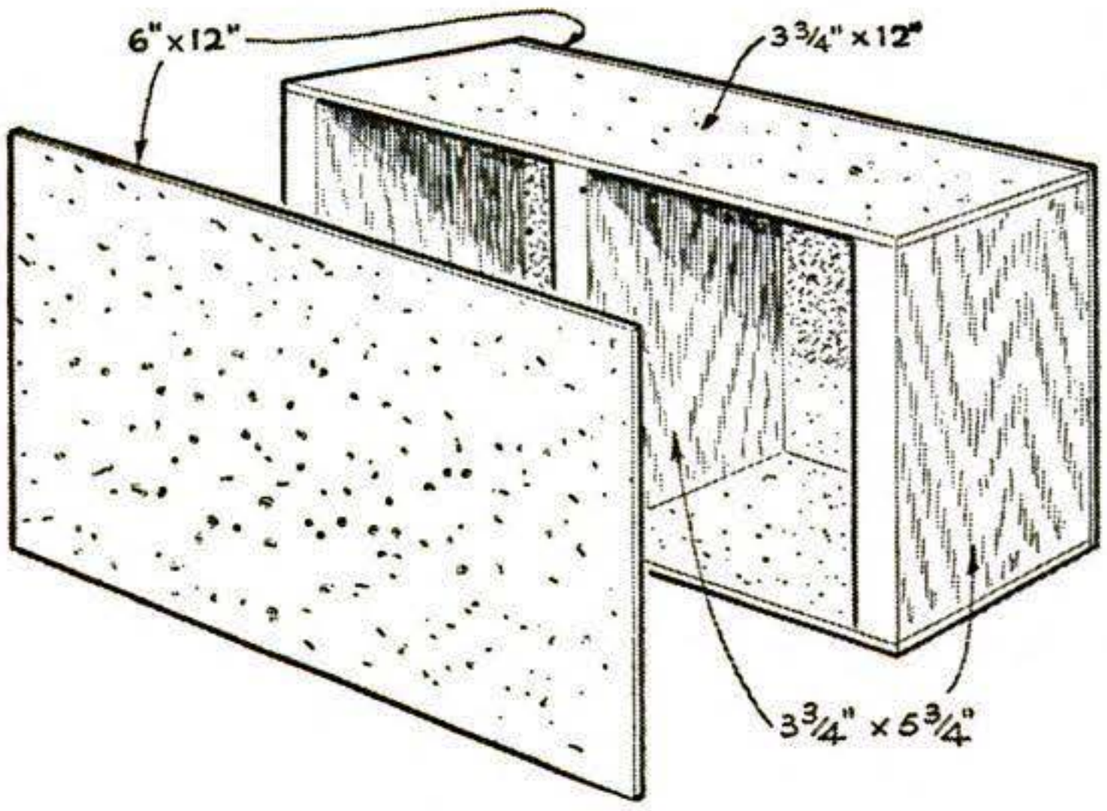
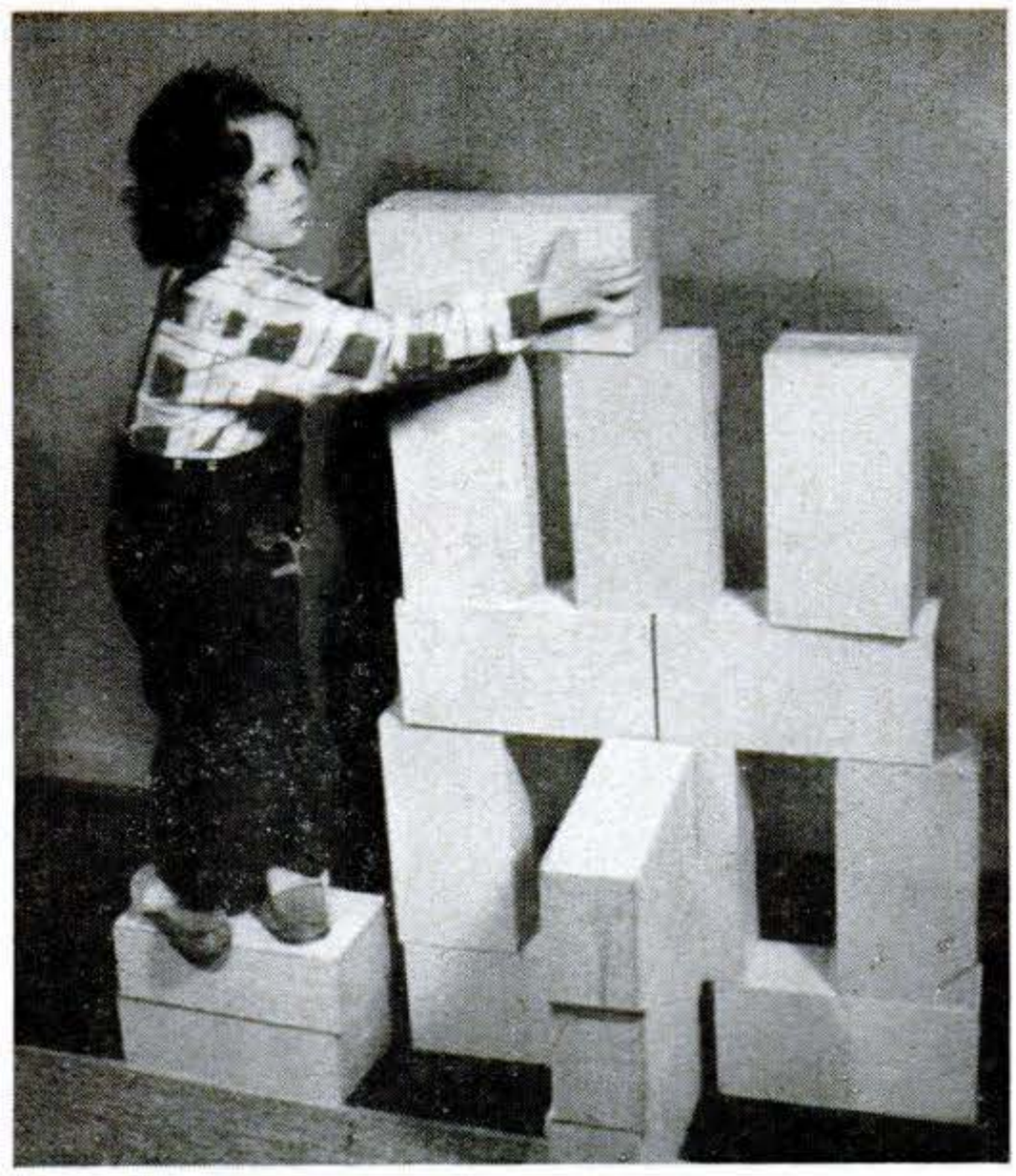
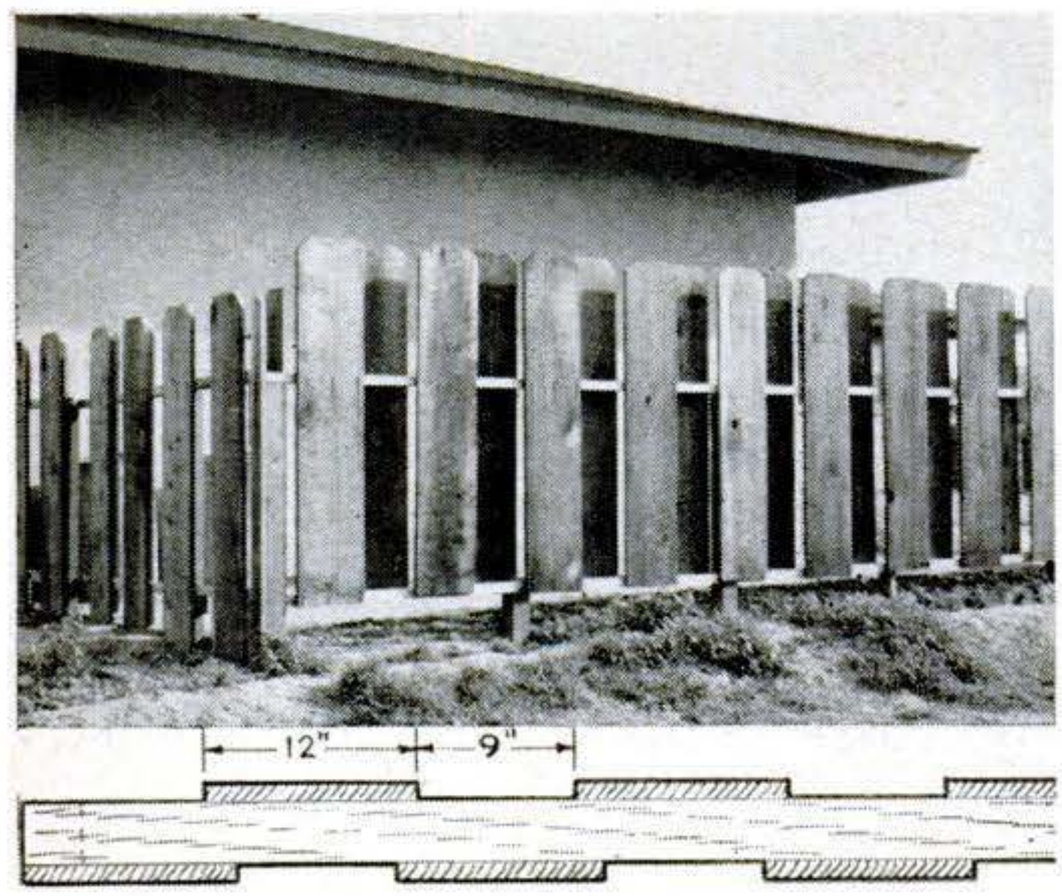




Jumbo Play Blocks Are Built of Lightweight Wallboard

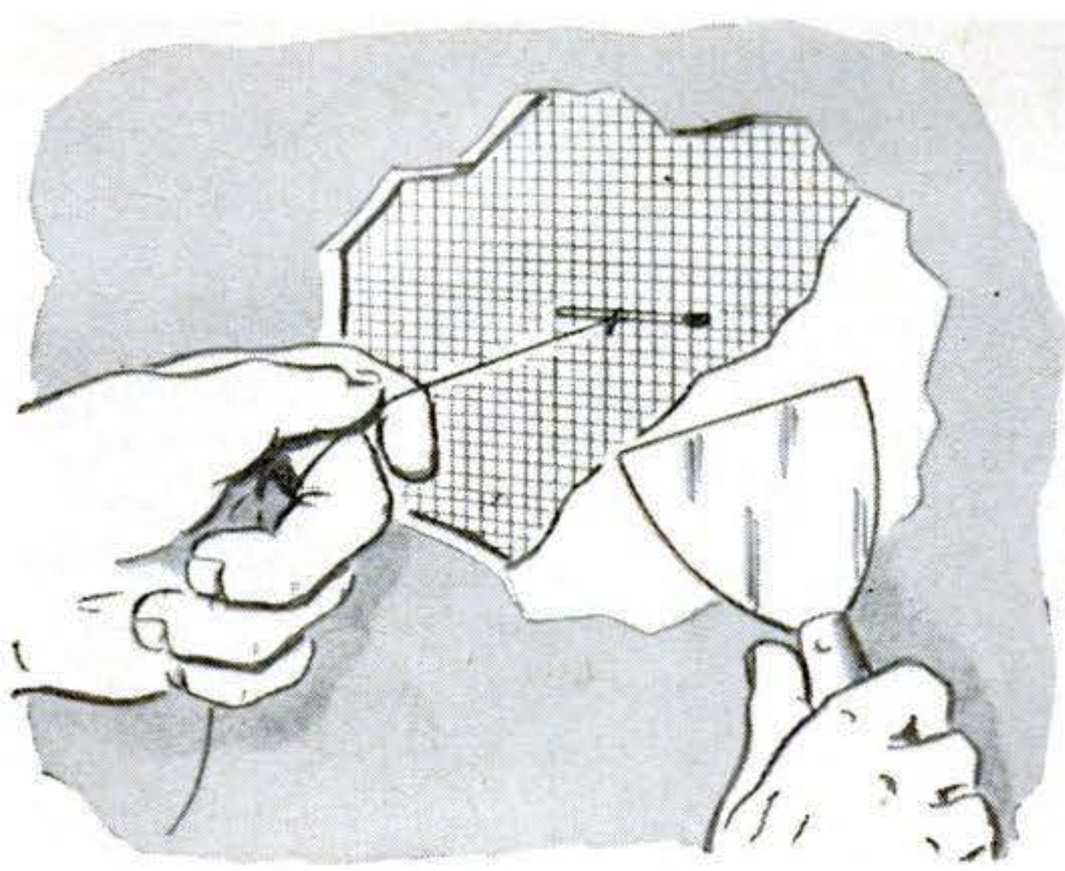
BIG, easily handled blocks, favorites of youngsters, cost plenty. You can make cheap but durable ones by combining pressed-paper wallboard with wood.

Three pieces of ¾″ pine form ends and center support of each block. The other four sides are cut from wallboard. I used 1″ brads to nail the sections together and coated each block with shellac.—*Rube Chernikoff, Washington, D.C.*



Vented Fence Lets In Air

STAGGER a board fence and it will admit cooling breezes as well as conceal your garden or patio from outsiders. Four-by-four posts, with the ends creosoted, and two-by-four stringers support boards of one-by-twelve stock. Sink the posts and nail the top stringers across the ends; then butt the lower stringers. For extra strength, a stub post can be set under the bottom stringers between each pair of main posts. You can paint the fence or let it weather.—*Hi Sibley, Nuevo, Calif.*



Mesh Backs Plaster Patch

A PIECE of window screen makes a good backstop when you're patching a hole in a plasterboard wall. Cut a patch larger than the opening and poke a string through the mesh. Tie a matchstick to the end of the string, drop it in the hole and push the rolled screen through. Pulling the string taut will now hold the patch in position. Spread spackle through the mesh and around edges of the patch.

When dry, cut the string and finish filling the hole.—*M. Greene, Orlando, Fla.*

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The new Torsion-Aire suspension system,* only on Chrysler Corporation cars, is the riding advance of the year. It isolates road shock—takes curves flat—eliminates jolting dive on stops. This is engineering leadership. Plymouth, Dodge, De Soto, Chrysler and Imperial.

**Another big reason why The Switch is On to the cars of The Forward Look*

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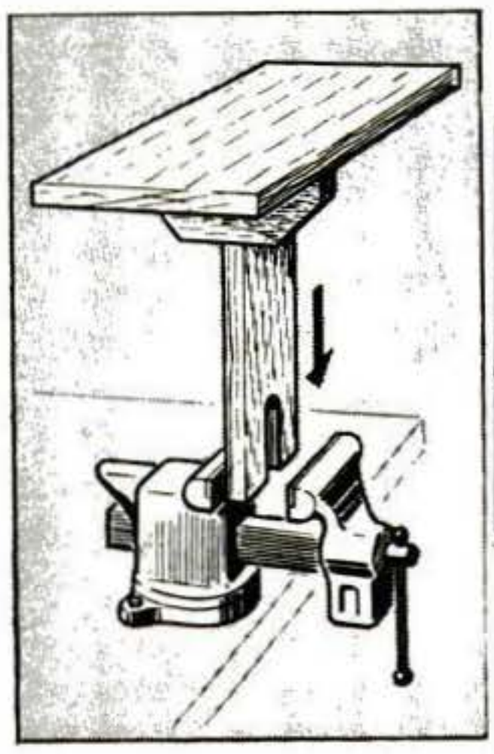
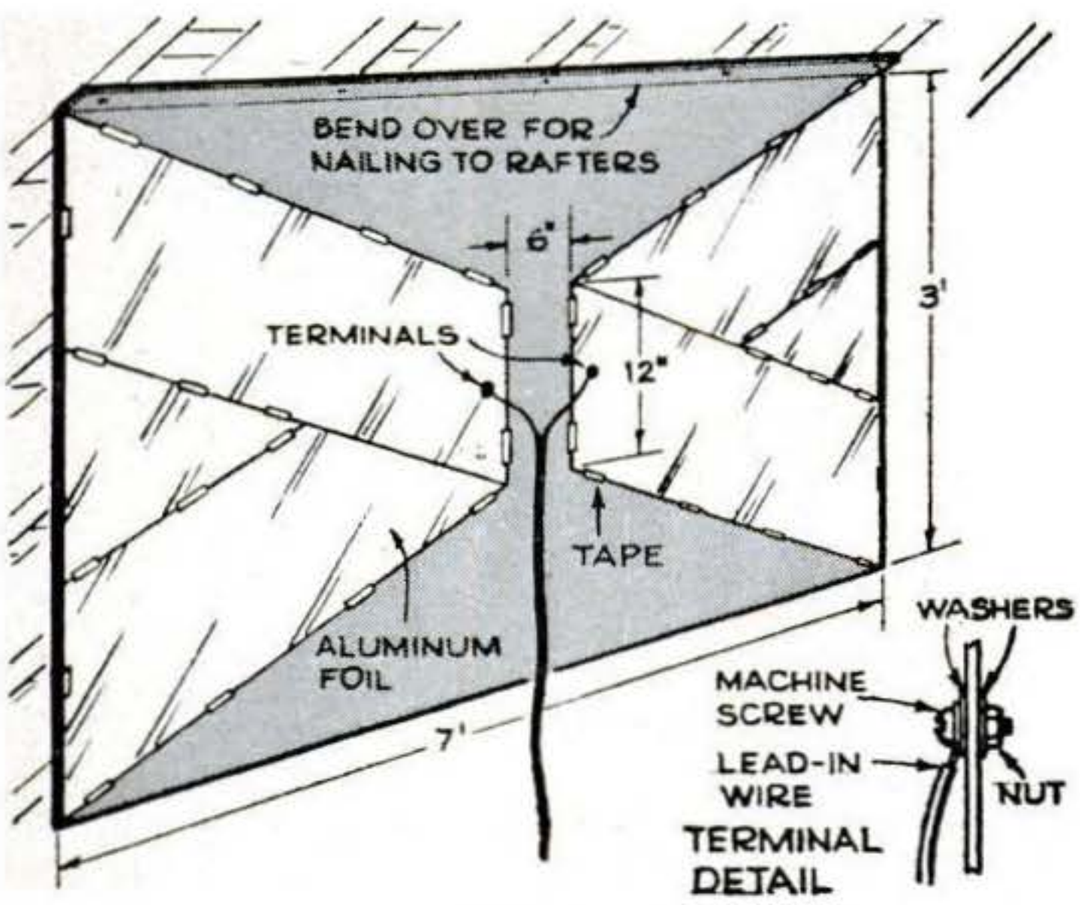
Short Cuts and Tips

Lift Adjusts Work-Table Height

You won't get a crick in your back bending over small projects if you clamp an extension table in your vise. Slot a one-by-three to straddle the vise screw and mount a small shelf on top. It will lift parts to easy working level.—*Frank A. Javor, Newark, N.J.*



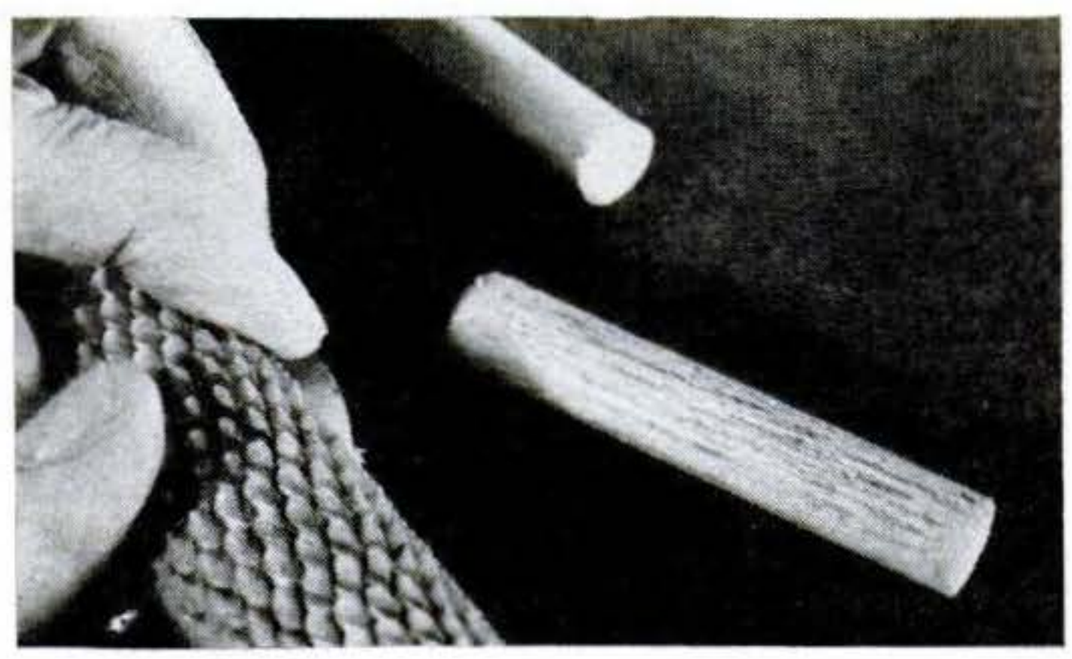


Attic Antenna Made of Foil

USING kitchen aluminum foil and a big sheet of corrugated cardboard, I built an attic TV antenna that brings in six out of seven possible New York City channels from a distance of 60 miles.

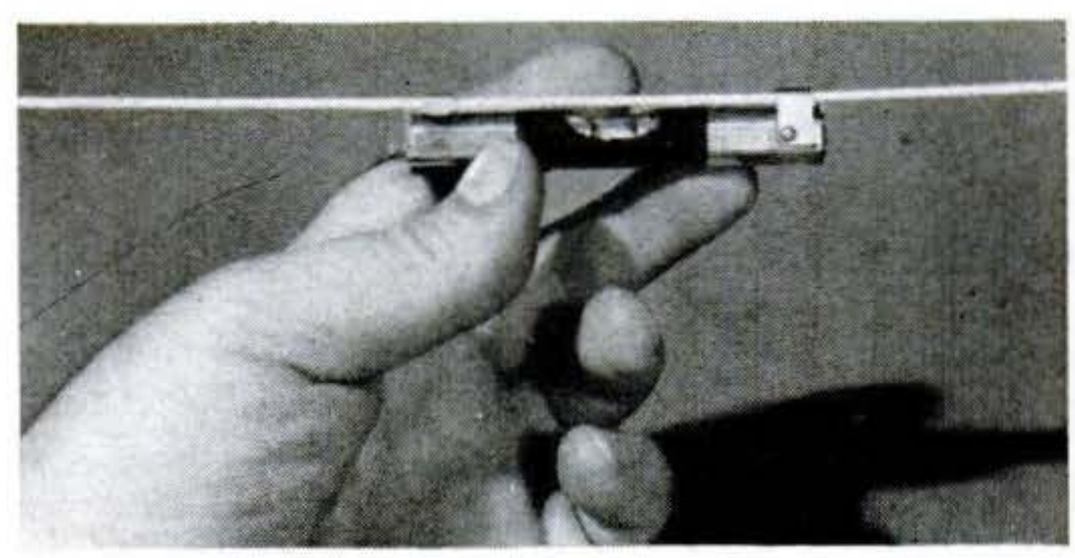
For broad-band reception, I folded two strips of foil into V's, taped them to the cardboard, as above, and filled the V openings with foil triangles. I made dipole terminals of machine screws, nuts and washers, and split the lead-in 10".

I oriented my antenna for best reception and found I could nail it to the rafters through a lip on the cardboard. You could invert it, tack the lip to the floor, and steady it with a prop.—*Herman Kreisler, Asbury Park, N.J.*



Roughened Dowel Holds Tight

DOWELS for glue joints can be given additional holding power by roughing them with a rasp. Roll the rasp over the dowel, applying heavy pressure.



Taped Level Is Easier to Read

IF YOU have trouble reading the bubble in a line level from a distance, cover the bright housing with black tape. The tape creates more contrast and eliminates reflection.—*Ken Murray, Colon, Mich.*

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If your headlamps look like these–

YOU NEED A PAIR OF NEW G-E *All-Weather* HEADLAMPS

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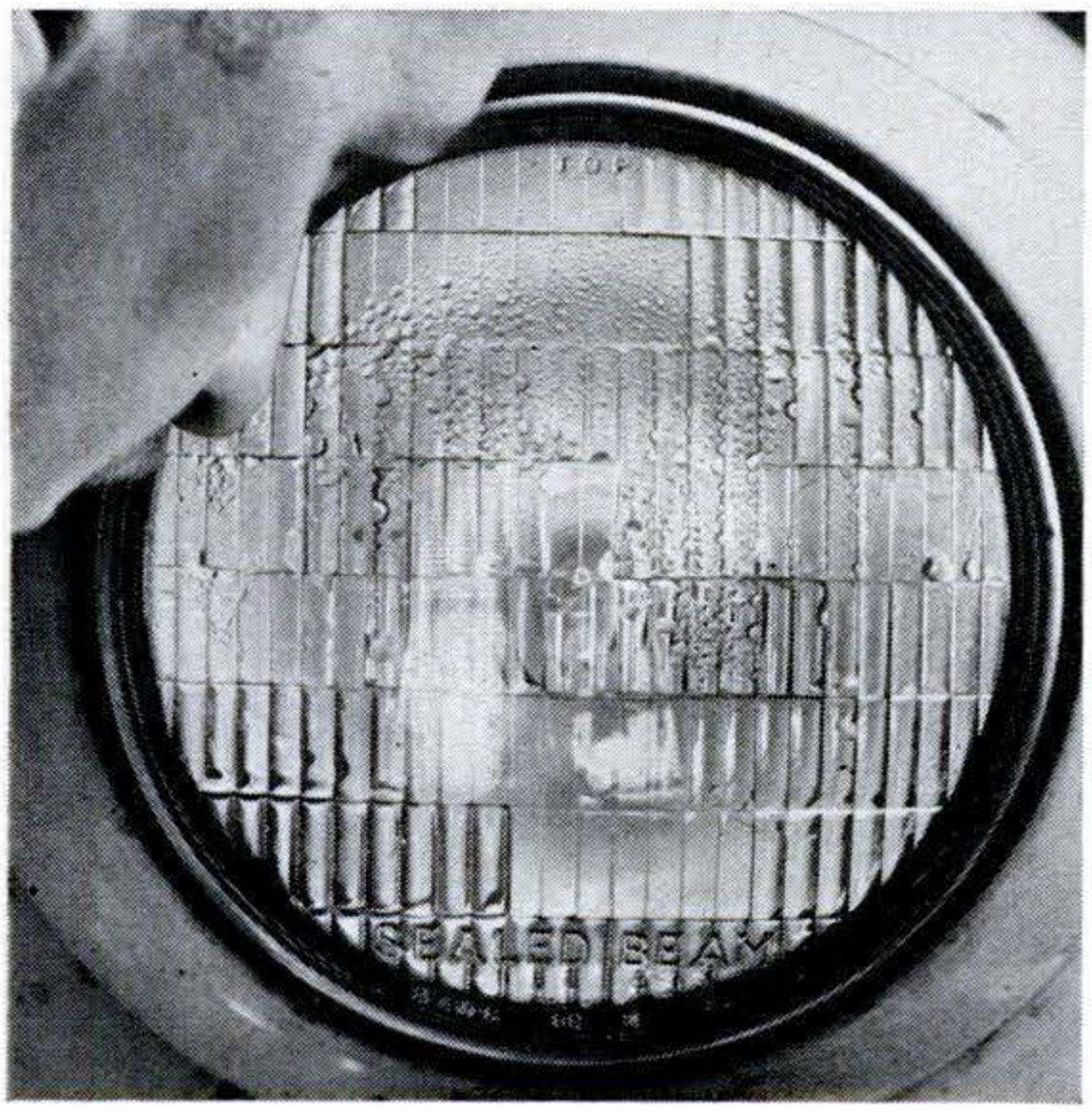
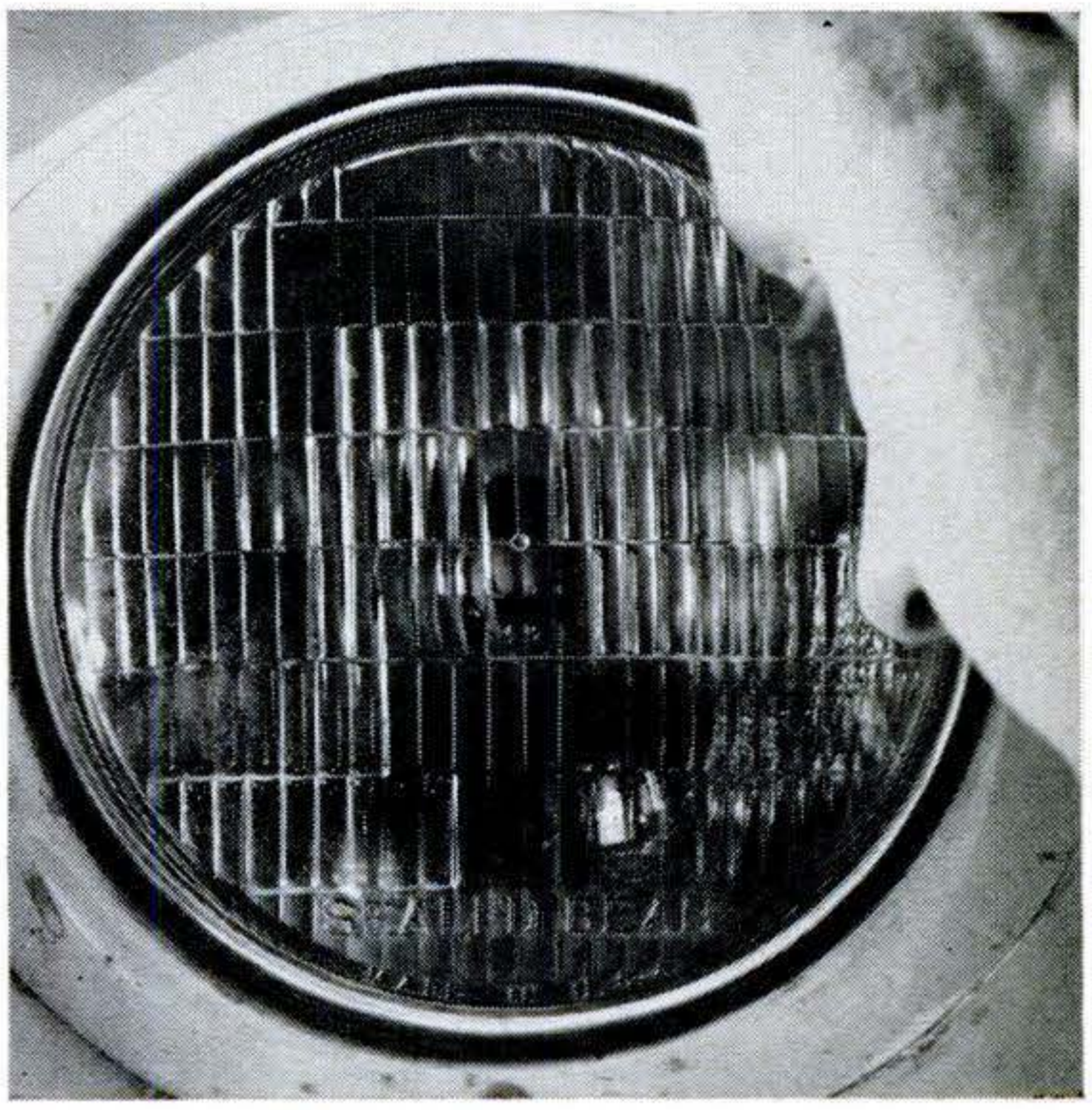
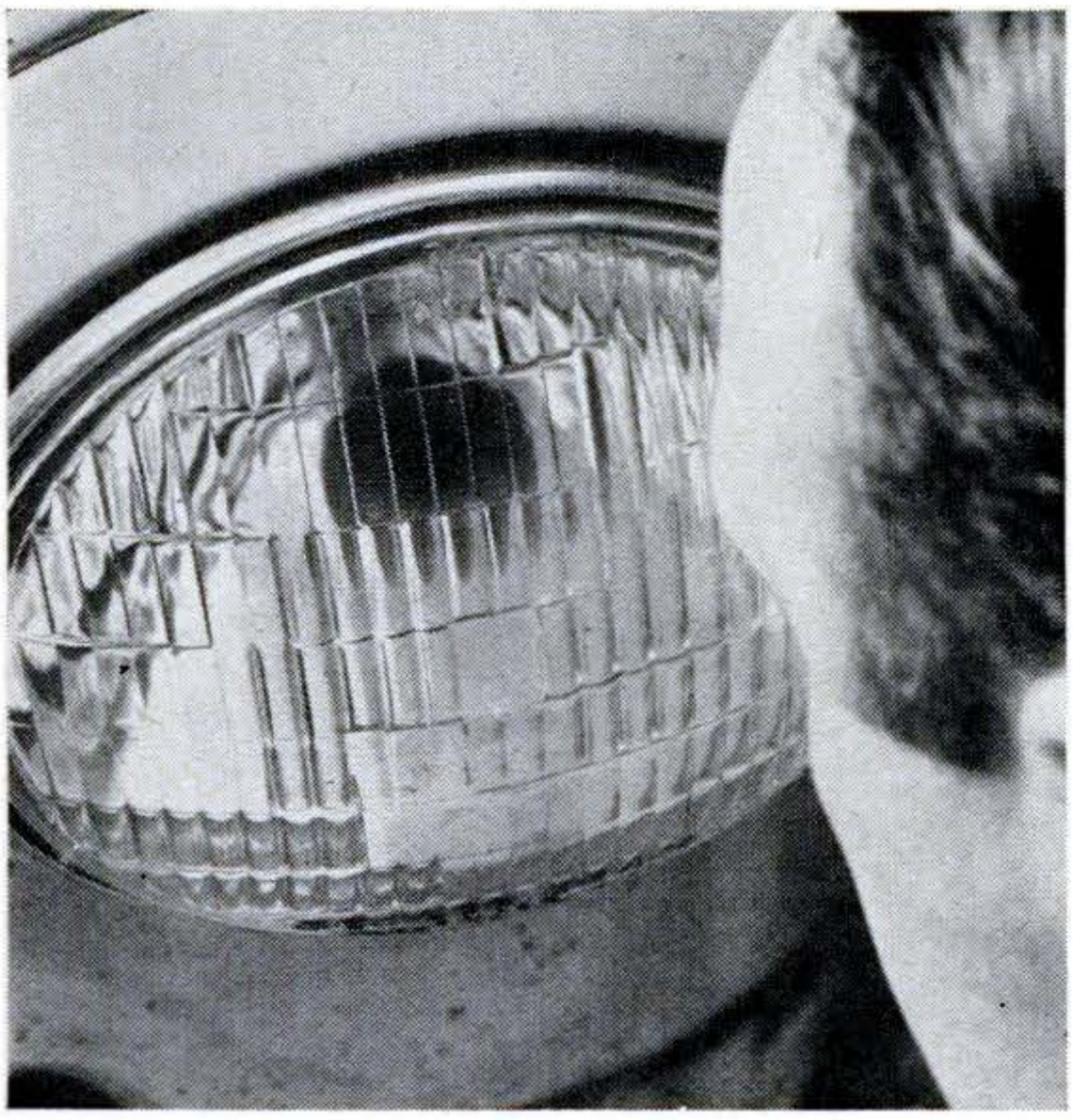


WATER DROPLETS inside the lens not only scatter the light, but they also help discolor metal reflectors. This can't happen with G-E *All-Weather* Headlamps—*moisture can't possibly get inside.*



DISCOLORED REFLECTORS absorb light rather than reflect it, causing a loss of up to 50% of the original light output. Dirt and moisture can never enter G-E *All-Weather* Headlamps so the *reflectors always stay shiny.*



BLACKENED BULBS in old-style headlamps block out the light from the filament and cause a dangerous drop in light output. This can't happen with G-E *All-Weather* Headlamps because *there are no inner bulbs!*

G-E *All-Weather* HEADLAMPS NOT ONLY GIVE YOU LOTS MORE LIGHT... BUT YOU ALSO GET:

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Lower beam puts twice the light 300 feet ahead at the curb—You can see much better against the glare of oncoming traffic.

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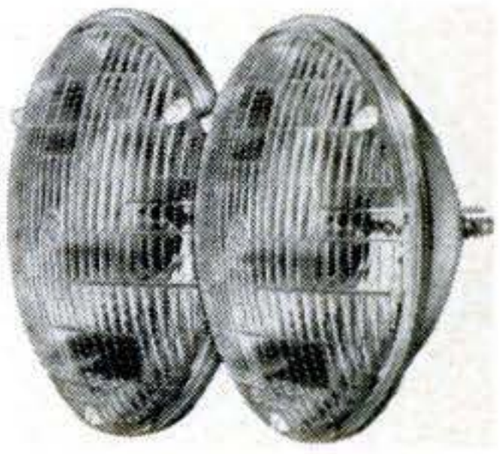
So, for safer night driving, get a pair of new G-E *All-Weather* Headlamps today — and have your dealer aim them when he puts them in. You'll see the difference tonight. General Electric Co., Miniature Lamp Dept., Nela Park, Cleveland 12, Ohio.



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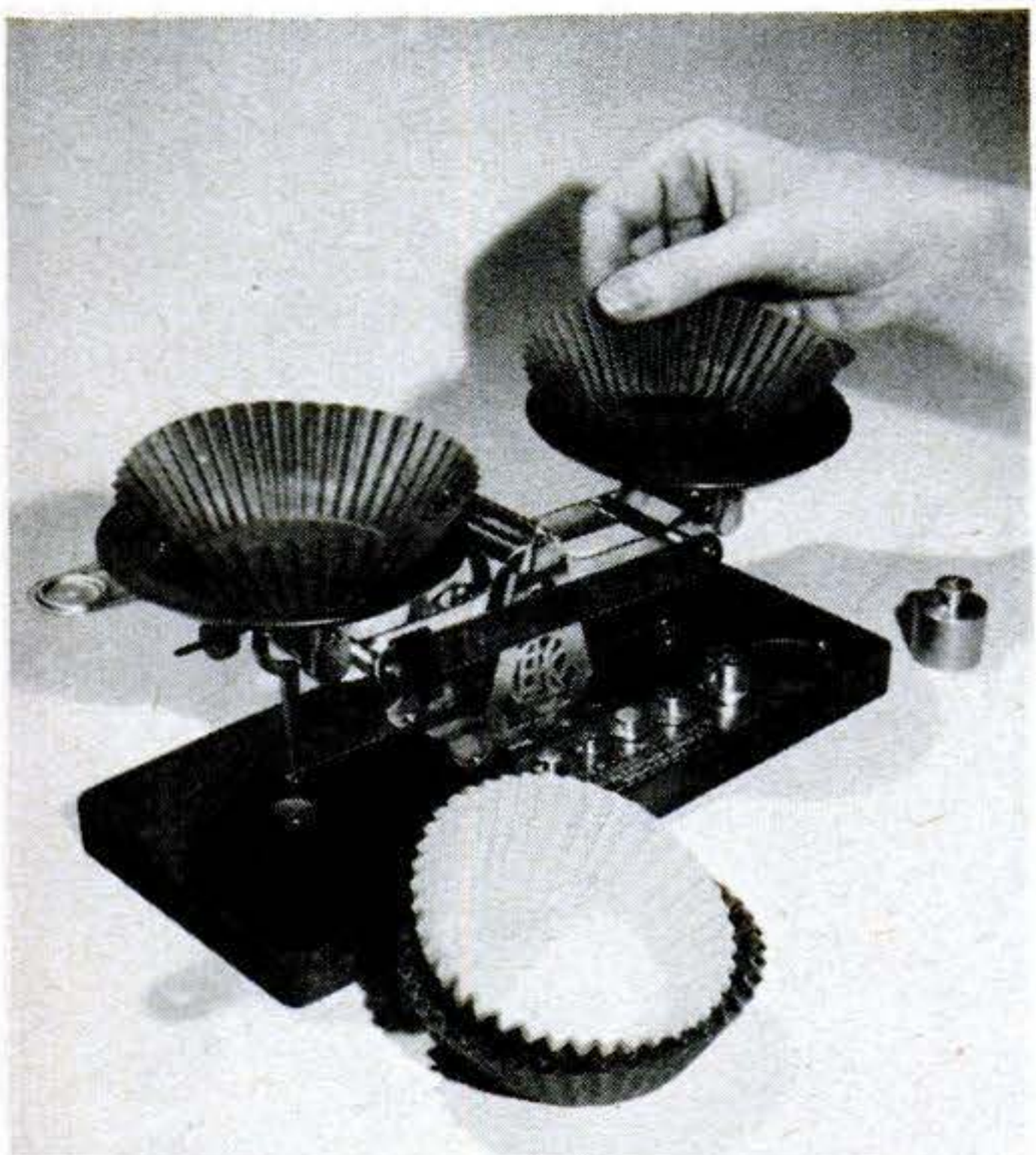
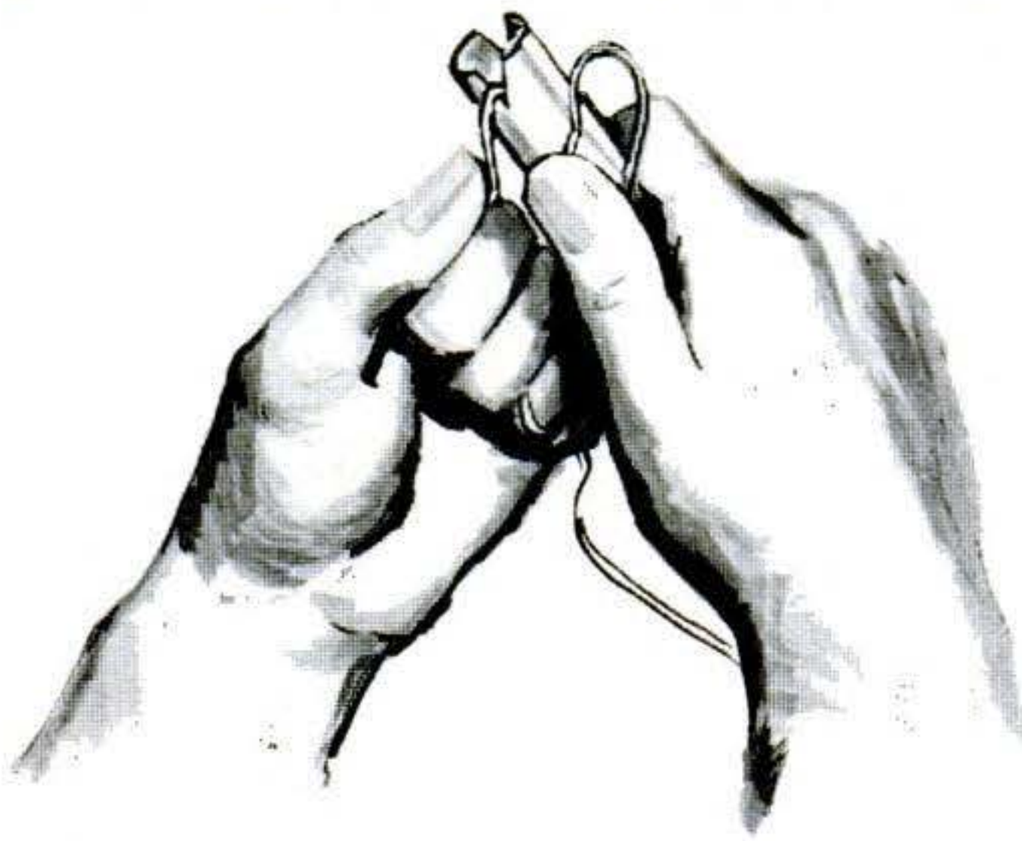


Baking Cups Hold Chemicals

PAPER baking cups make inexpensive, disposable liners for balance pans when you're weighing darkroom or shop chemicals. To get very precise measurements, use an empty cup in the weight pan to even things up.—*Fred Jackson, St. Louis.*

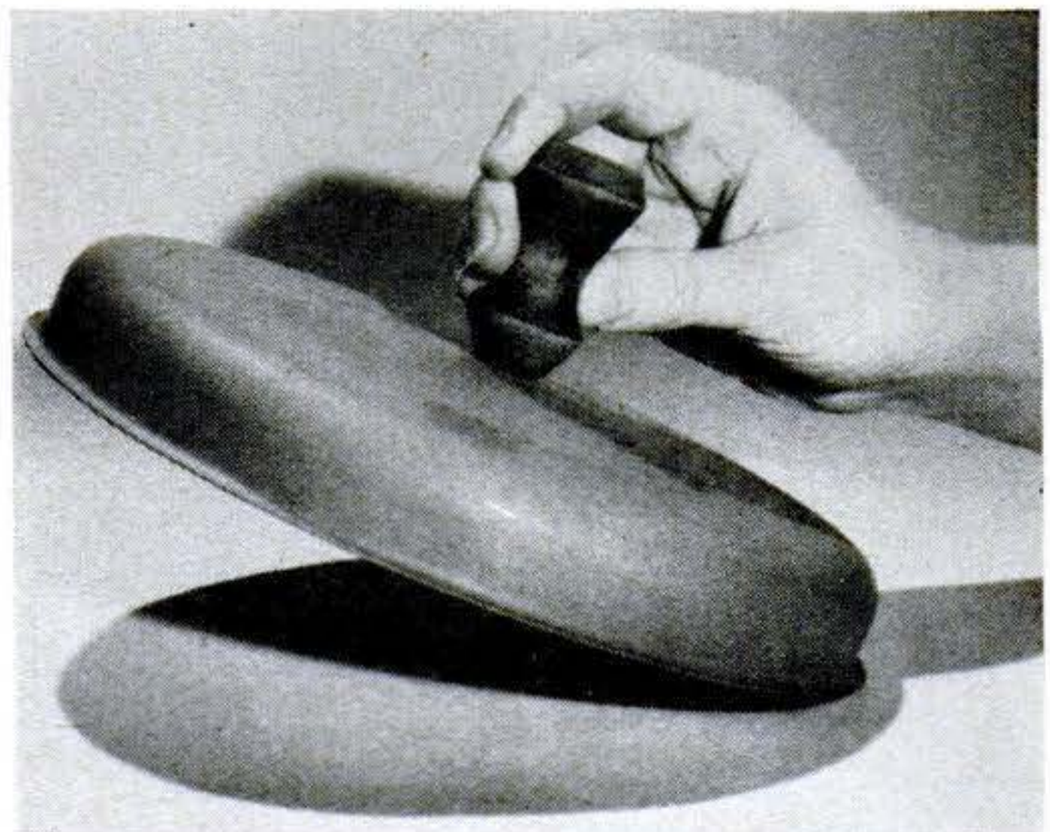


Notched Tube Cuts Twine

NOTCH one end of a piece of metal tubing with a triangular file and you get a handy twine cutter. Pull twine up through the tube, measuring out the length needed. Snip it off with a slight tug against the notch.—*George Glowaty, NYC.*

Swatter Becomes Barbecue Fork

THE handle of a discarded fly swatter makes a good toasting fork for your outdoor fireplace. Straighten the open ends, sharpen the tines so that they'll pierce franks or marshmallows easily, then sterilize them in the flames of the fire.—*Victor H. Lamoy, Upper Jay, N.Y.*



Husky Pot Handle Aids Grip

DAINTY knobs on pot covers can frustrate outdoor chefs who try to grasp them with mitt or pot holder. I substitute big knobs made from wooden doorstops. Removing its screw, I shorten a stop by sawing off a bit at that end. Then I discard the tack at the tip and screw this end to the lid.—*Jack Franklin, Newark, N.J.*

▶▶▶IF YOU must haul freight on the car top, put a deflated inner tube under the load and lash it all down. Then inflate the tube to make a protective cushion.

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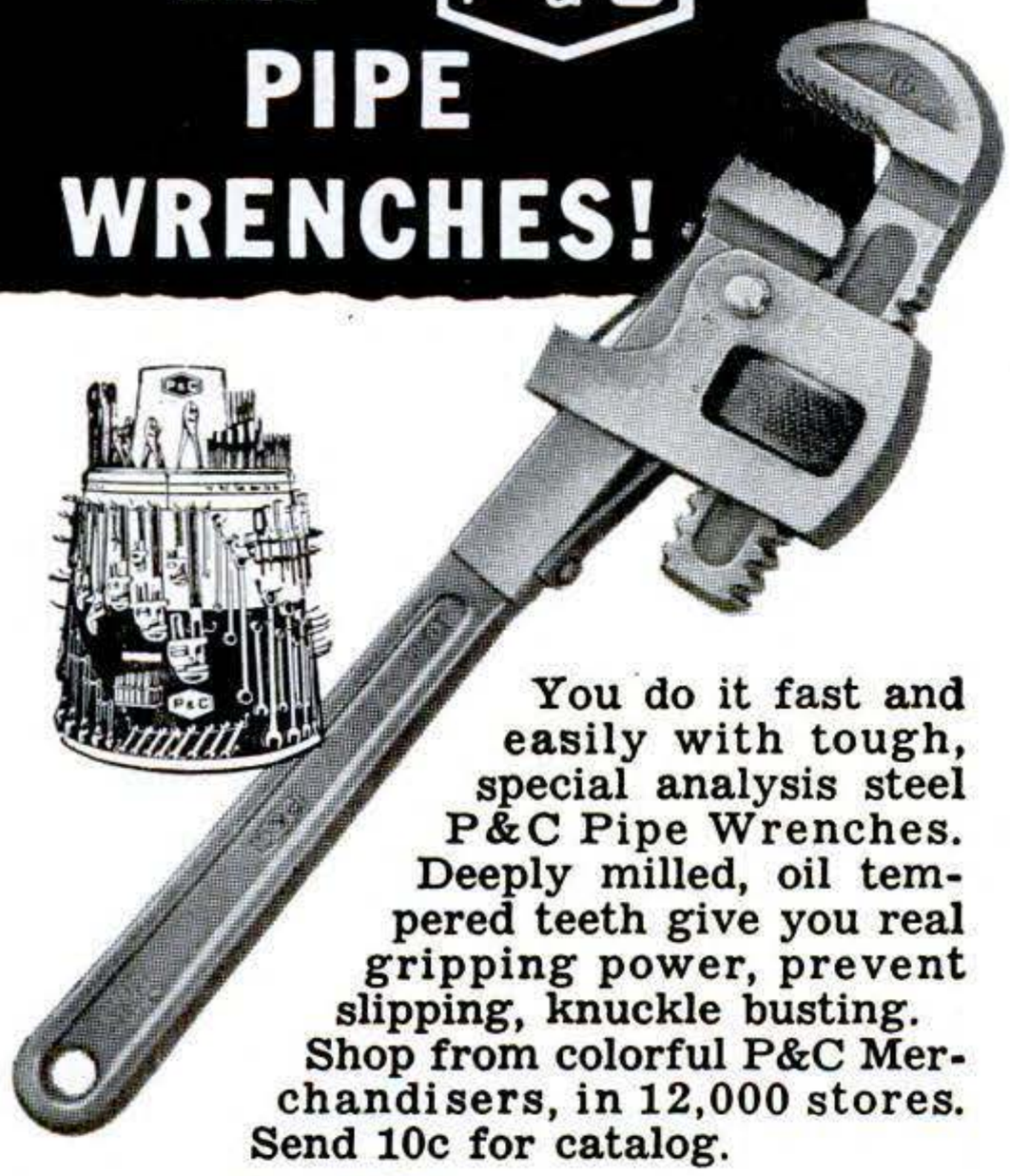

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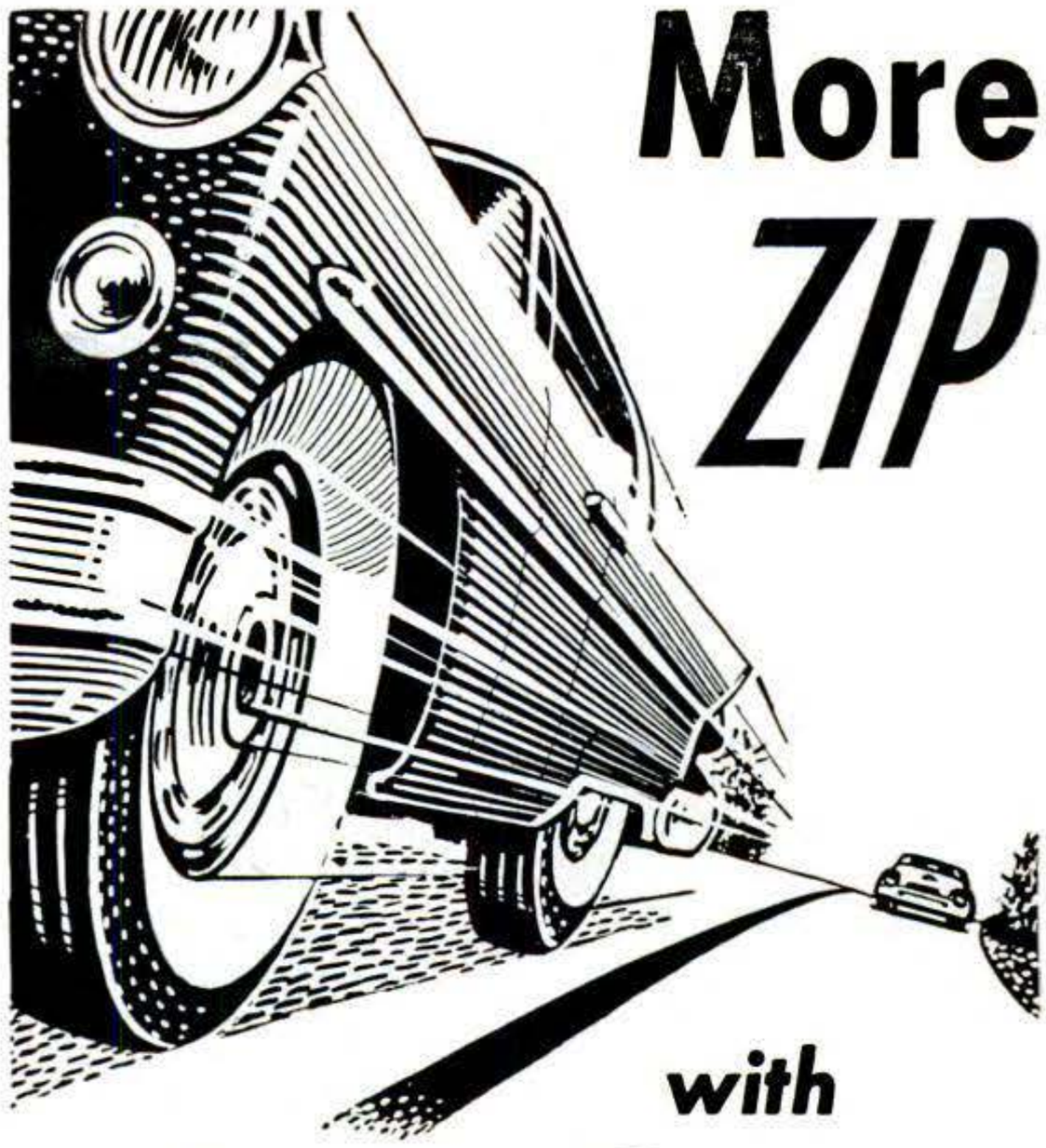

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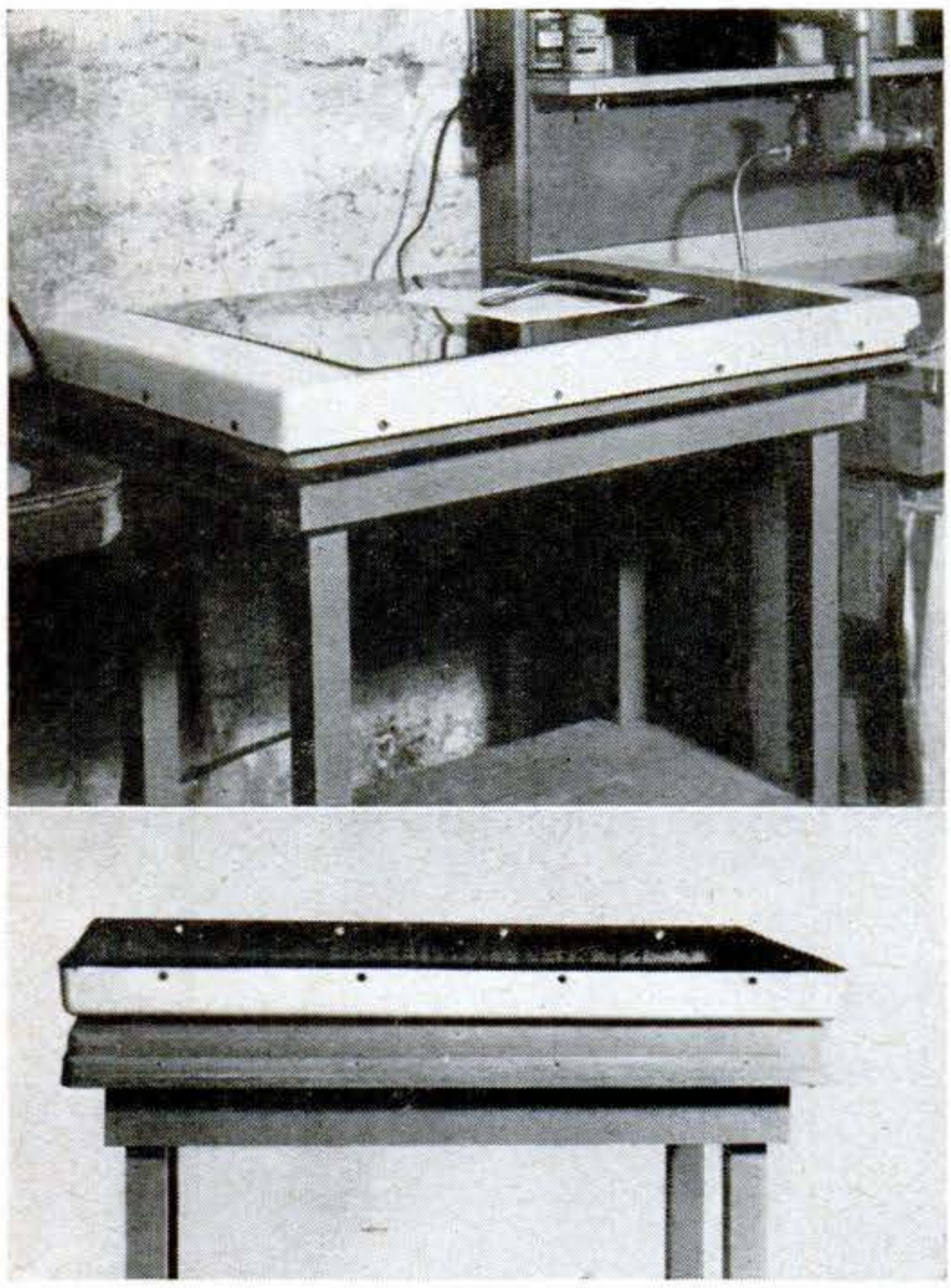


Darkroom Table Turns into Tray

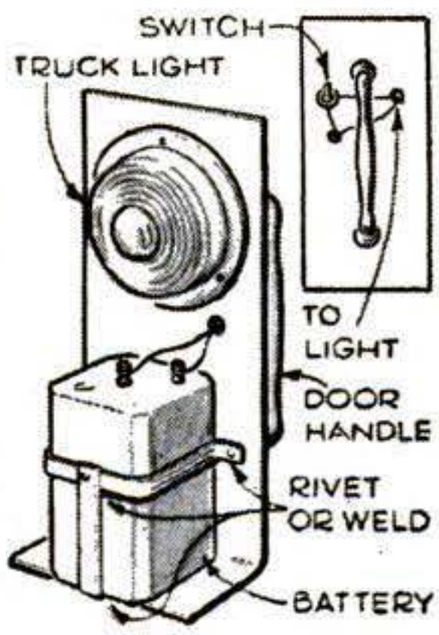
I HAVE a porcelain-topped, double-duty darkroom table that didn't cost a penny. It's made from the inner lining of an old wood-core refrigerator door, which can be picked up from a refrigerator dealer or junk yard. With the porcelain side up, it makes a smooth, stainproof surface for ferrotype sheets or for working with chemicals. Lifted off its frame and flipped over, the lining becomes a super-large tray for washing extra-big blowups.

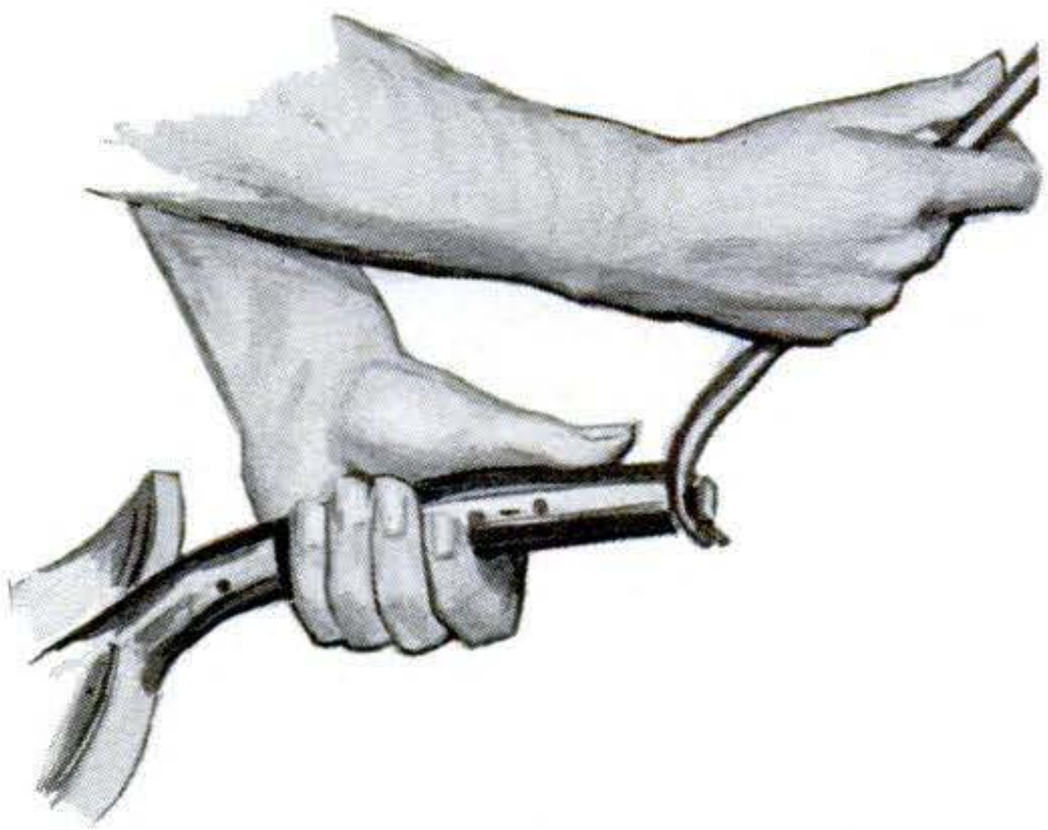
Construction is easy because you use the original wood framework of the door, which matches the contour of the inner metal panel. Discard the outer panel and insulation. Then nail or screw legs into the corners of the frame.

Adding dress-up skirt boards just below the frame, and a storage shelf farther down, increases the table's rigidity. I fitted cross braces inside the frame to keep the metal panel from springing when it's pushed.—*H. R. Clark, Springdale, Ark.*

Truck Light Makes Lantern

A FLUSH-TYPE truck clearance light makes a lantern when mounted on sheet metal. Rivet or weld two straps to the mount to hold a six-volt battery on the bent-up lower end. Connect the terminals to the light through a switch. Attach a handle.





Lag Screw Pulls Out Stub

A SHOVEL or rake handle that has broken off inside the shank can be pried out with a lag screw. Drill out the rivets and drill the stub end to take the screw. Drive it in so that a pinchbar inserted between the protruding screw head and the rim of the shank will lift out the handle stub. —*Charles H. Hardy, Whittier, Calif.*

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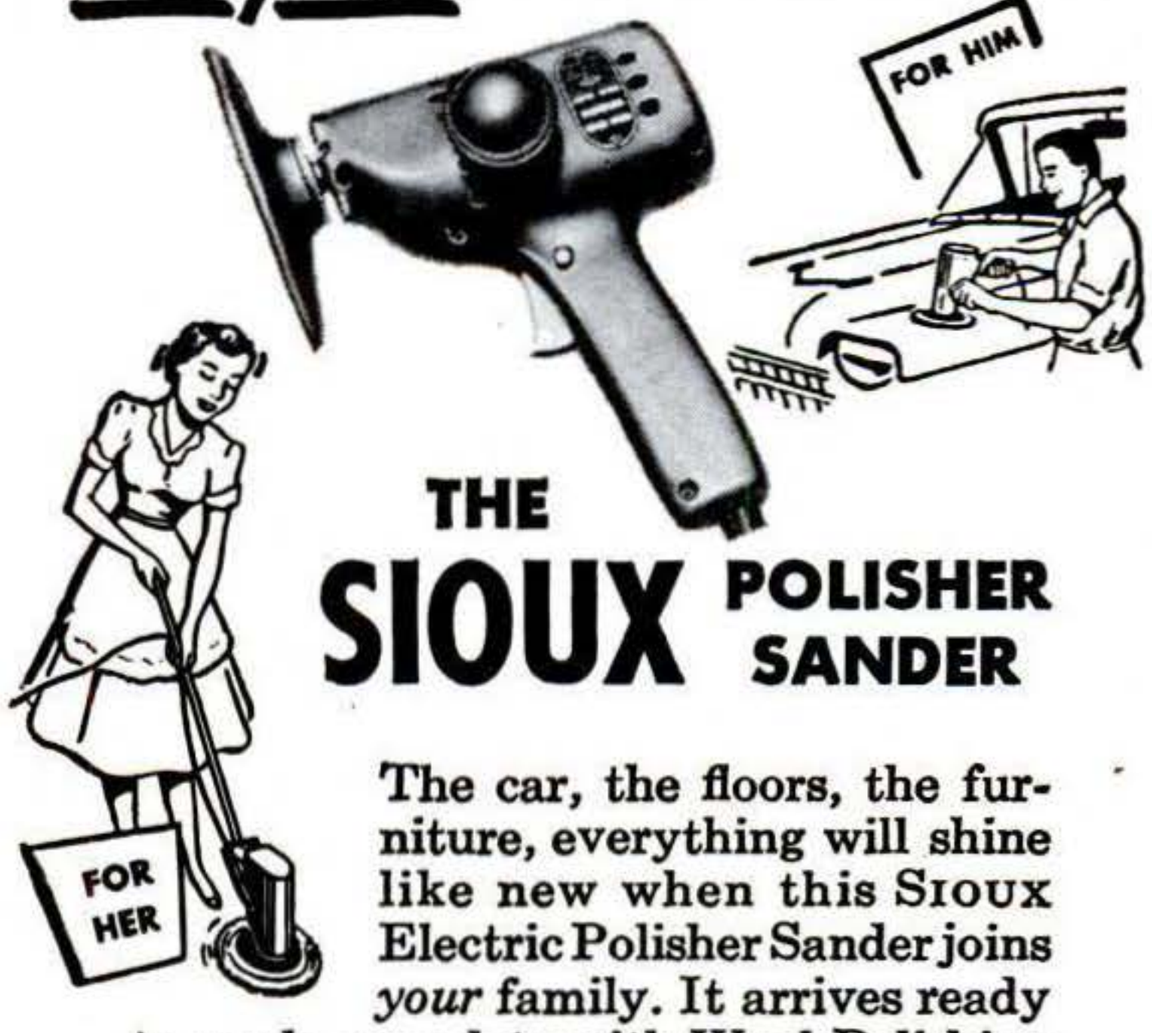

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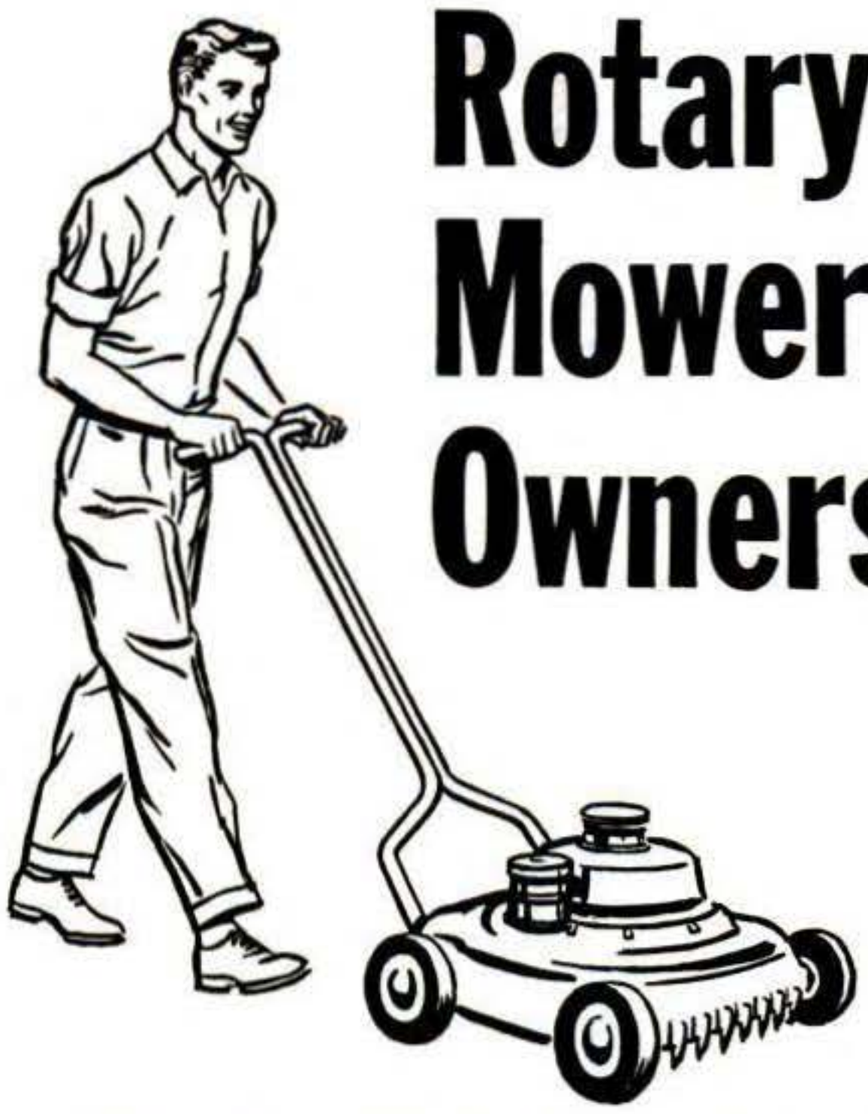

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What to do if a police car orders you to pull over

● Stay calm. The officer may only want to warn you of a soft tire, a wobbling wheel or a burned-out tail light. Even if you know you've violated the law, don't panic. Resign yourself and make the best of it.

● Ease up on the gas first, then brake gently. Pull off the road as far as possible—completely off a parkway or throughway. Don't slam on the brakes.

● Stay in the car. Roll down your windows and wait for the officer to approach.

● Make no sudden moves. A car of the same general description as yours may have been reported stolen or in use by a criminal. The officer cannot be sure you aren't reaching for a gun, instead of a handkerchief.

● Don't argue or offer excuses. That you didn't mean to speed doesn't help. If you claim an emergency, better be prepared to justify it. A siren-sounding police escort to a hospital can be extremely embarrassing if you didn't really mean to go there.

● Be courteous. It's galling to be caught in a fault, but the cop is under orders to be polite to you. Give him the same courtesy. He's doing a tough, often disagreeable, but very necessary job.

[Continued from page 54]

get away." He was wrong to the tune of a $100 fine and 30 days in jail.

After giving the driver of a '56 Ford a ticket for having a Hollywood muffler, Michigan Trooper Harold Karnitz saw him drive on and squeeze another car off the road. As Karnitz followed, the Ford ran through three stop signs at busy through-highways—at 110 m.p.h. Because they were approaching the state line, Karnitz radioed both his own and Ohio authorities. But the pace was telling on the Ford's driver; he pulled up while still in Michigan. His reason for running? "You just gave me one ticket. I didn't want any more trouble."

An alternative to shooting at the tires, but almost as risky, is bumping the speeding car on the left rear fender. More often, if a driver is drunk or otherwise apparently incompetent, the police car will draw abreast and gradually nudge him off the road.

Speeding the other way won't save you from the sharp eyes of a cop in an oncoming patrol car. Police are practiced in gauging speed this way. (One radar officer at the Lansing barracks of the Michigan State police can reliably estimate high speeds by eye to an accuracy closer than five m.p.h.) Said Bill Demlong, a Connecticut State Trooper with whom I rode the Merritt Parkway, "I get more cars speeding in the opposite direction than I do going my way." If the trooper can't make a U turn, he radioes a police car patroling ahead of the speeder or, on toll roads, has him held at the booth.

Speeders doing 10 m.p.h., back in the buckboard days, were overhauled by constables pedaling bicycles at 12 m.p.h. But for decades the speeder's nemesis was the motorcycle cop, a fellow with educated legs, a good seat and cast-iron nerve. Highly vulnerable to bad weather and rough roads, he became all too expendable as car speeds crept up.

Today, motorbikes are generally considered too dangerous to ride in pursuit. A secondary reason they're losing out to the patrol car is that radio can't be heard as readily or transmitted as far as with car equipment.

Airplanes play a part in highway enforcement, too, although the chief function of police planes is to help direct traffic flow. (Able to see how long traffic lines are, police pilots can regulate stop-and-go intervals or divert cars from overloaded roads to advantage.) Roof

[Continued on page 246]

A congressman comments on this article

With more than 40,000 lives being lost annually in highway traffic accidents, it behooves us to give our best to meeting this problem. POPULAR SCIENCE *is doing a distinct public service by calling attention to the fact that the speeder has little chance to escape a police car. Speed is a definite factor in causing traffic accidents, as are alcohol and untrained drivers.*—The Hon. Kenneth A. Roberts (Ala.), Chairman, Special Subcommittee on Traffic Safety.

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Why You Can't Outrun the Police

[Continued from page 244]

numbers on police cars assist in radio communication with the planes, which are also used to direct ground hunts for fugitives, lost hunters and children.

Unmarked police cars are used to crack down on willful violators, especially in heavy traffic periods. As for the fable that police have to make a regular quota of tickets, officers say, "We don't, but if we did, it would be a cinch."

How long or how far a police car must clock speeders varies in different states. But it's worth remembering that the quarter mile or other prescribed distance is covered in a few seconds at high speeds.

When speed's the essence, police drivers show their stuff. I was riding with Michigan Trooper Glen Perry and his partner one afternoon when a personal-injury accident report came in on the radio. "That means us," said Perry. He swung around, turned on the roof flasher, and picked up to 90 m.p.h. Riding in back with no seat belt, I hung on hard. Homebound workers clogged the highways. Perry swung around them at top speed when possible; when blocked, he touched the siren gently until the cars ahead pulled off, then sped up to 90 and 95 again, the car fishtailing slightly on the crowded two-lane highways.

Without tire-squealing turns, howling siren or narrow squeaks, he wheeled through and around rush-hour traffic at speeds I'd drive only on a test track. At through highways he came to a near stop, then picked up again fast. The 25-mile run was impressive testimony to Perry's skill and the car's performance.

The siren, though required on emergency cars by law, is no license for running red lights or stop streets. Police know that drivers may not hear it with their own radio blaring or windows shut. Nor is it directional; even when it's right behind, a driver may look for it in every direction but the right one. Nor do police want to panic a driver into

[Continued on page 248]

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Why You Can't Outrun the Police

[*Continued from page 246*]

such an urge to get out of the way that he steers up a tree.

It takes all kinds. In dealing with that collection of human beings, the public, police officers meet every kind of reaction. I heard one driver thank the trooper who had given him a ticket. I heard a speeder, after pleading guilty in court and paying his fine, accuse the officer of clocking him falsely. A reckless speeder, asked by a cop whether he was looking for sudden suicide, answered blithely: "It's safe; I've got seat belts."

Drawing alongside a pickup he'd clocked at over 65, Trooper Demlong signaled its driver to stop, and pulled over in front of it. To his amazement, the pickup dodged around him. Demlong raced after, ordered him off again. The pickup ducked a second time. On the third try, it was finally stopped.

"Why didn't you stop the first time?" the trooper demanded.

"How could I?" asked the driver plaintively. "This thing has no brakes."

Radio makes life tough for the wise guy. Michigan Trooper Perry was doing the nighttime limit of 55 when he spotted a car behind closing up on him fast. Simultaneously the driver awoke to the fact that he'd overhauled a police car, for he slowed down. But he stayed at the limit, scarcely three feet behind.

About to stop him for tailgating, Perry heard the radio say, "Why not U-turn off here and let me take him?"

It was a second police car behind the offender. Perry made a U turn and drove off. Feeling safe, the driver sped up to over 100 m.p.h., until the second car hauled him over. He's still wondering how Perry made a second U turn and caught up with him so fast.

In the New York area, vacationing drivers brag of making the heavily trafficked run to Miami in two days. One trooper mentioned that he had driven down. I asked him how long it took him.

"Four and a half days," he said with a grin. "I didn't want to get a ticket for speeding." END

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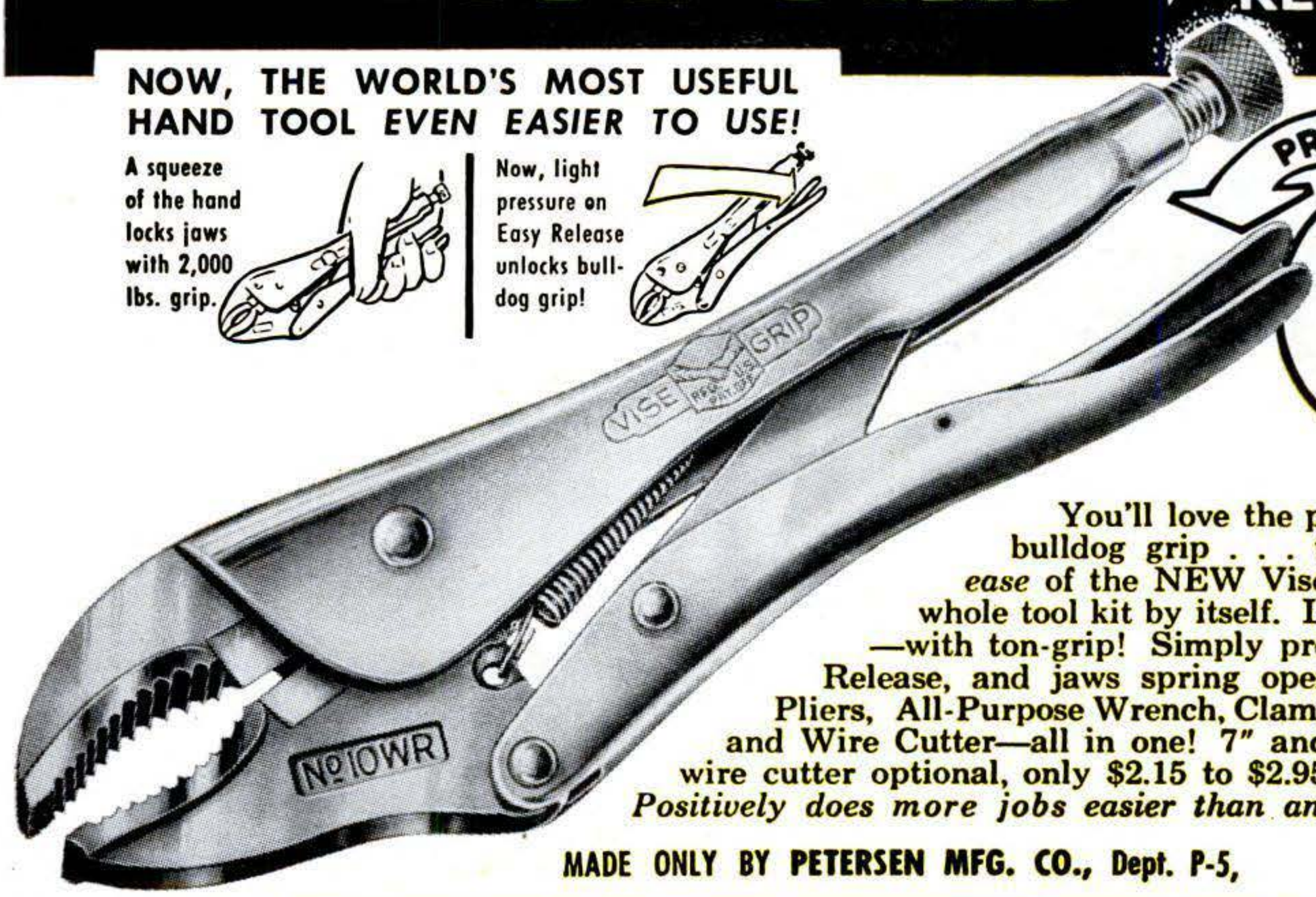

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Is Your Child a Budding Scientist?

[Continued from page 63]

If your child's school is one of the many with a guidance-counseling program, it is important to take full advantage of it.

But what if the school doesn't have such a program? Ask your public library for the *Directory of Vocational Counseling Agencies.* (If the library can't provide it, order it for $1 from its publisher: American Personnel and Guidance Association, 1534 "O" St., N.W., Washington 5, D.C.) This directory tells you the nearest place where you may take your son or daughter for both testing and subsequent guidance. It is a more reliable source, incidentally, than the counseling listings in the classified phone book.

"There are a lot of quacks in this business," says one respected guidance counselor. "The Directory was devised to list only those agencies that meet professional standards of ethics and competence."

What you should do. If test results and professional advice indicate that your child has the makings of an engineer or scientist, how can you help?

One step is encouragement. Don't put obstacles in the way of any scientific hobby. If your youngster's school has a science club, urge him to join it. If a science fair is held nearby, encourage him to work up an exhibit.

It is particularly important to see that he takes all the essential courses that his school offers. For a career in science or engineering, he should take *all* the precollege mathematics and science (general science, physics and chemistry) courses he can get.

Some high schools, unfortunately, don't provide enough. Eleven percent of all high-school seniors, according to a recent study, have no opportunity to learn trigonometry, solid geometry or intermediate algebra. Six percent of them attend schools that don't offer any courses in physics or chemistry.

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[Continued on page 252]

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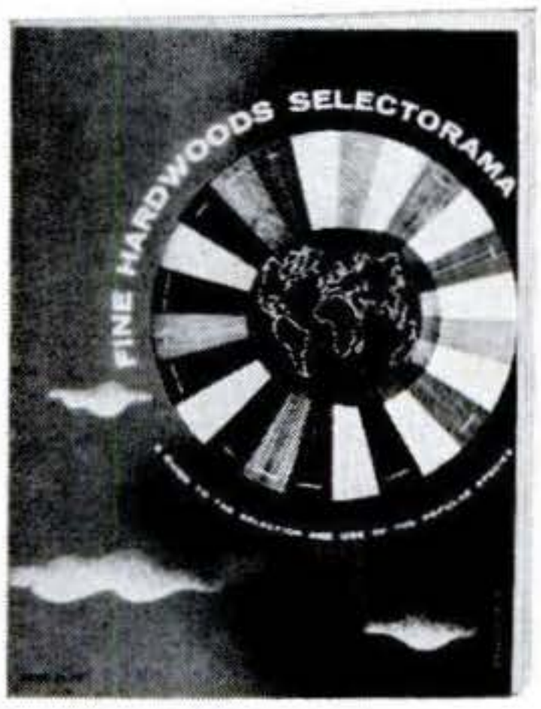

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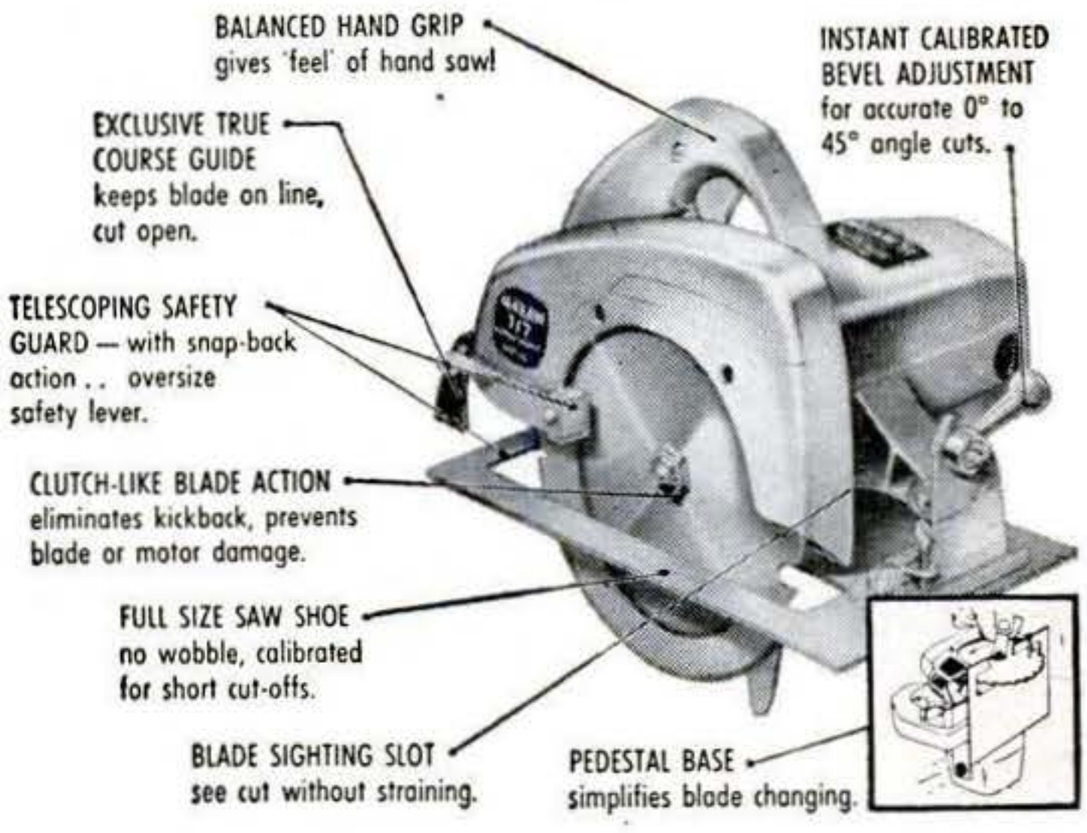

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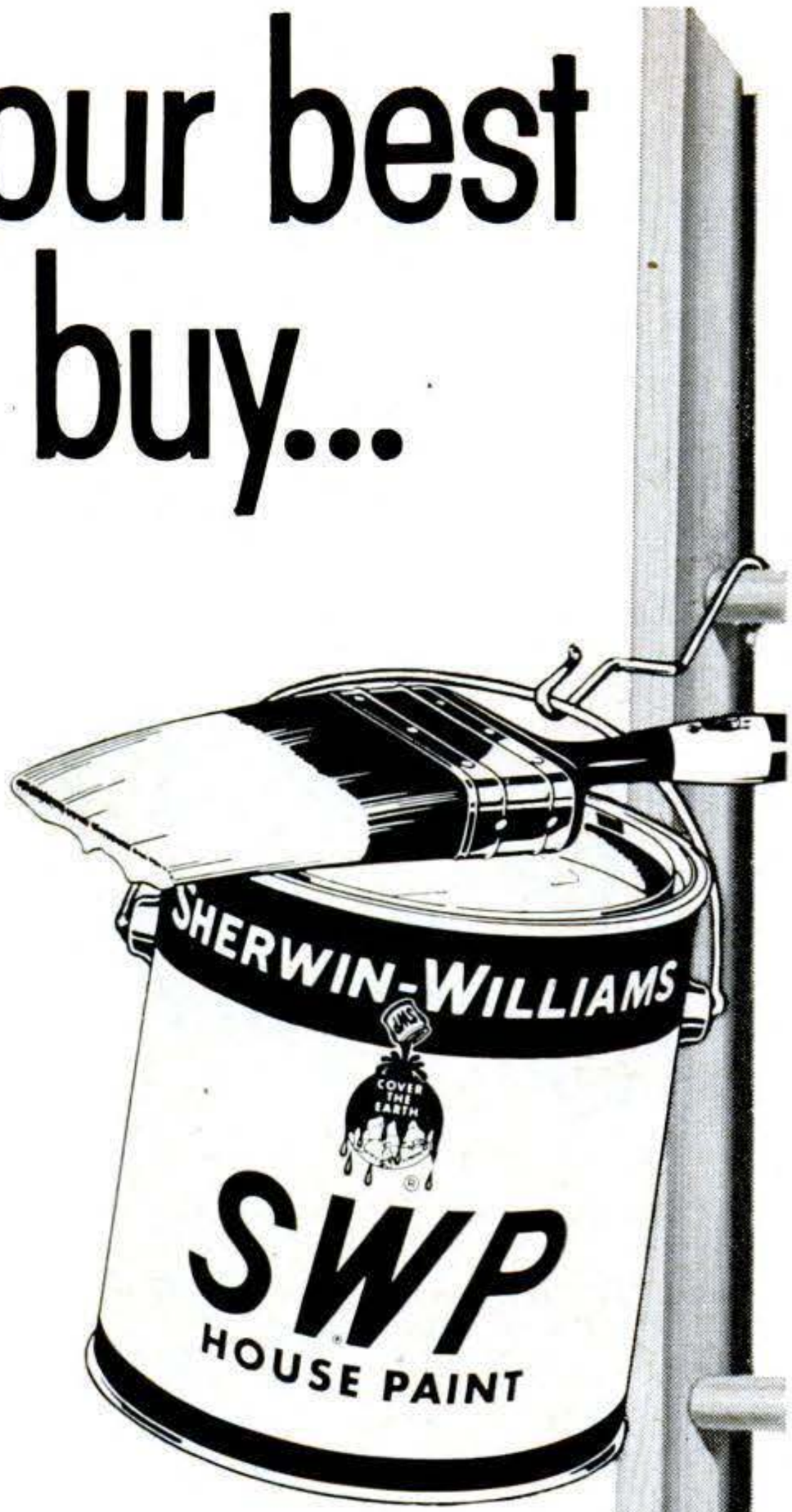

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HOUSE PAINT

Is Your Child a Budding Scientist?

[*Continued from page 250*]

school, consider the possibilities of a transfer. If that isn't practical, it is possible to make up the deficiency by taking correspondence courses. One source of information is the National Home Study Council, 1420 New York Ave., N.W., Washington 5, D.C.

Daughters, too. A girl who is deeply interested in mathematics or science presents a special challenge. First you may have to help her and her mother overcome a common feeling that it is unfeminine to train for a career in engineering or science. The danger of blighting her intellectual enthusiasm may arise long before high school:

"A girl's budding interest in science can be discouraged if, when she asks for a microscope to look at insects and worms, her mother tells her that a girl should be interested in dolls," writes Dean Charles C. Cole Jr., of Columbia, in *Encouraging Scientific Talent.*

If by approval and encouragement you can help your daughter prepare for a scientific career, she will have wide-ranging opportunities—and not just for such familiar jobs as nurses, medical technicians and science teachers. Laboratories and industry have a host of jobs that scientifically trained women can do. Engineering, too, provides steadily greater opportunities for women. "They are needed in research, development, design, planning, testing and quality control," John S. Lampe says in *An Engineering Career for Your School-Age Child.*

Then why are there so few women engineers? Lampe explains: "Because parents did nothing at the high-school level to promote the idea that engineering could be an attractive career for a girl, even though she may have shown outstanding mathematical, scientific or mechanical aptitudes." **END**

ANSWERS to test on page 63:
A—3 and 4
B—1 and 3
C—2 and 4

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Crystal Signals Long Distances

RADICALLY new long-distance communications systems on earth, and radio telescopes to detect interstellar objects that cannot now be seen, are among results expected from the new electronic oscillator called "maser." It's a solid crystal—like a transistor, unlike a vacuum tube—that may eventually be used as an amplifier as well as an oscillator.

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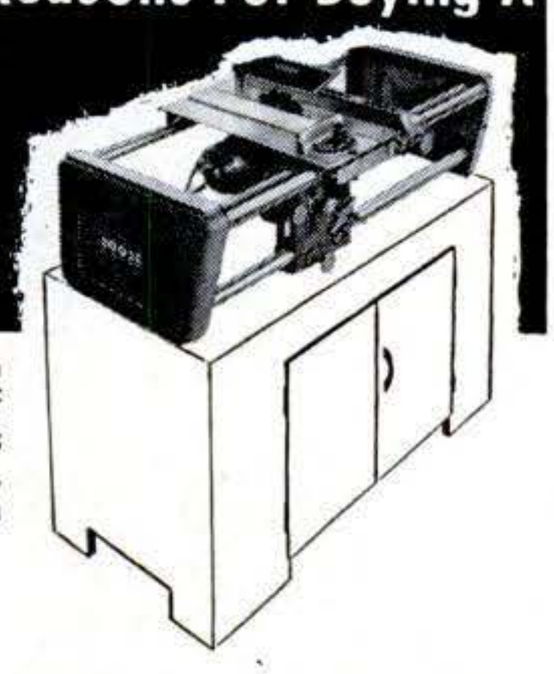

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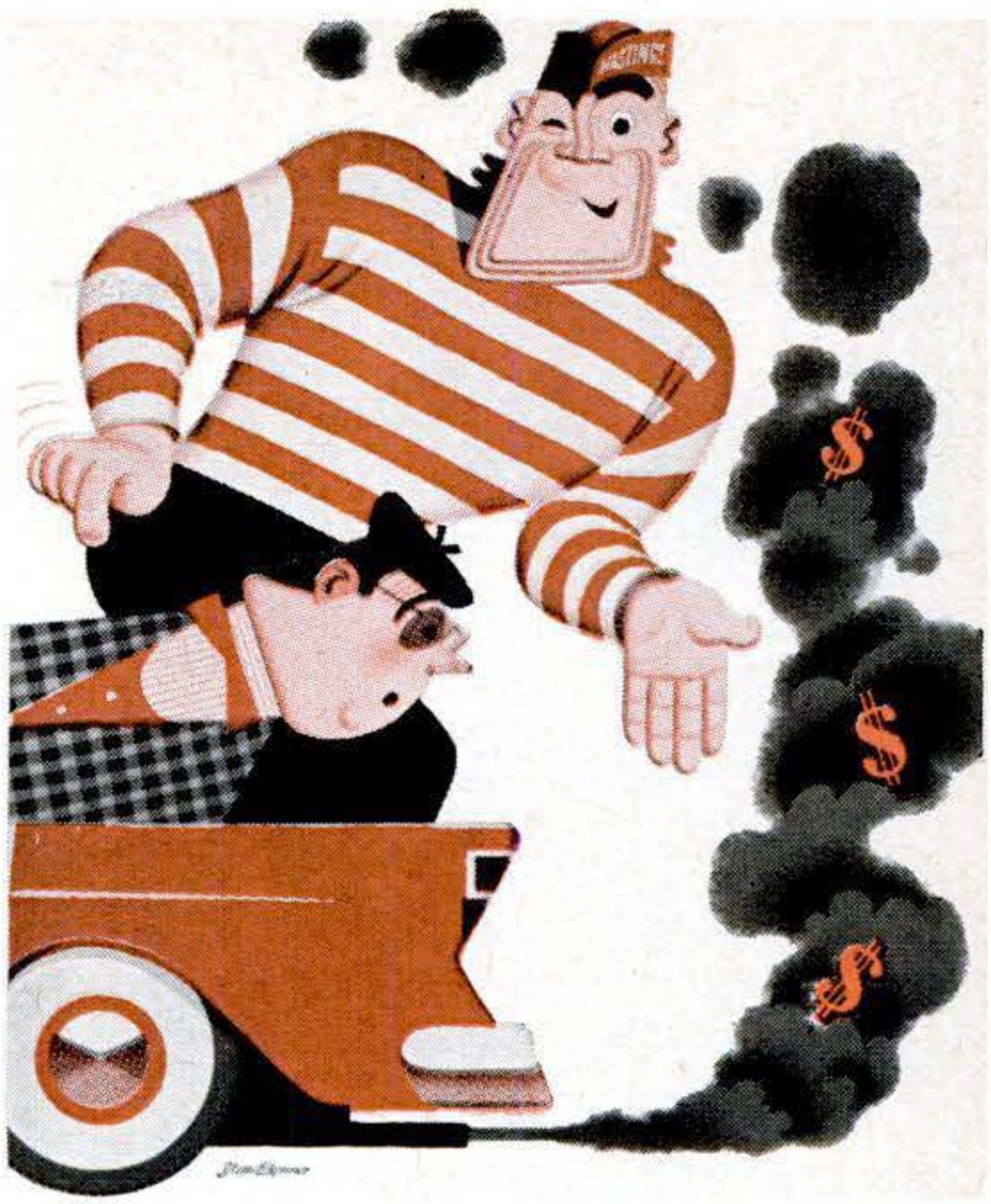

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• Tests both 6 Volt and 12 Volt Storage Batteries • Generators • Starters • Distributors • Ignition Coils • Regulators • Relays • Circuit Breakers • Cigarette Lighters • Stop Lights • Condensers • Directional Signal Systems • All Lamps and Bulbs • Fuses • Heating Systems • Horns • Also will locate poor grounds, breaks in wiring, poor connections, etc.

Handsome round-cornered molded bakelite case, 3⅛"x5⅞"x2¼". Complete with all test leads. Also included is a 64 page book giving detailed instructions, for testing all electrical appliances, automotive equipment, TV tubes, etc. Only **15.85**

THE NEW MODEL 505 WEN **PORTABLE ELECTRIC JIG SAW**

7 Saws in one!

does the work of a RIP . . . CROSSCUT . . . COPING . . . JIG . . . SCROLL . . . BAND . . . and KEYHOLE SAW

CUTS ANY MATERIAL! SAWS ANY SHAPE! RIPS AND CROSS CUTS 2 X 4'S.

IT CUTS — WOOD, METAL, PLASTICS

IT SAWS - CIRCLES, CURVES, INTRICATE DESIGNS

Makes fast, smooth cuts . . . no jumping or chattering. Has the capacity to rip and cross cut 2 x 4's. Specially built 1.8 Amp motor assures steady cutting. Air-stream blows sawdust away from guide line. Blade changing is quick and easy. Light weight—only 3½ lbs.

SPECIFICATIONS:

Motor—115 V. AC-DC 1.8 Amp Rating. Switch—UL Approved Heavy Duty Slide Switch. Overall Length—6¾". Overall Height—less blade—5". Load Strokes per Min.—2,650. Length of stroke—⅝". Cord—6' Heavy Rubber—Molded Plug. UL Approved. **29.95**

Complete with 3 different Blades.

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Try either of the above units for 10 days before you buy. If completely satisfied then send down payment and pay balance as indicated on coupon. No Interest or Finance Charges Added! If not completely satisfied, return unit to us, no explanation necessary.

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Please rush the unit(s) checked. If satisfied, I agree to remit the down payment within 10 days and to pay the monthly indicated rate. If not satisfactory, I will return within 10 days for cancellation of account.

☐ Model 70....Total Price $15.85 —$3.85 within 10 days. Balance $4.00 monthly for 3 months.

☐ WEN 505 Electric Jig Saw Total price .....$29.95 $8.95 within 10 days. Balance $7.00 per month for 3 months.

Name.....

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City.....Zone....State.....

All prices net, F.O.B., N.Y.C.

Tiny Sub Maneuvers Like a Plane

[*Continued from page 66*]

bottomed excursion boats. I didn't know what I had run into. Looked like some crazy fish staring at me with 80 eyes. Those eyes, I realized after almost swallowing my mouthpiece, belonged to the tourists on board the thing."

Later, the glass-bottomed boat's skipper told Osborn that some passengers were shouting, "Look at that big, ugly yellow fish!"

MINISUBS are painted yellow for a good reason. "The color seems to scare the sharks," Osborn says. "We boast that our MiniSubs are shark-proof."

Osborn has demonstrated the MiniSub at U. S. Navy bases from the Hawaiian Islands to the eastern seaboard. One close shave came off the coast of Nova Scotia when he was showing the MiniSub to officers of the Canadian Navy. One of the sub's fins snagged on the underside of a cruiser as Osborn attempted a bow-to-stern run beneath her.

"It was midnight black down there," he remembers. "I couldn't tell what had happened. I popped open the hatch and swam to the surface on the double. Later, the MiniSub dislodged and floated up."

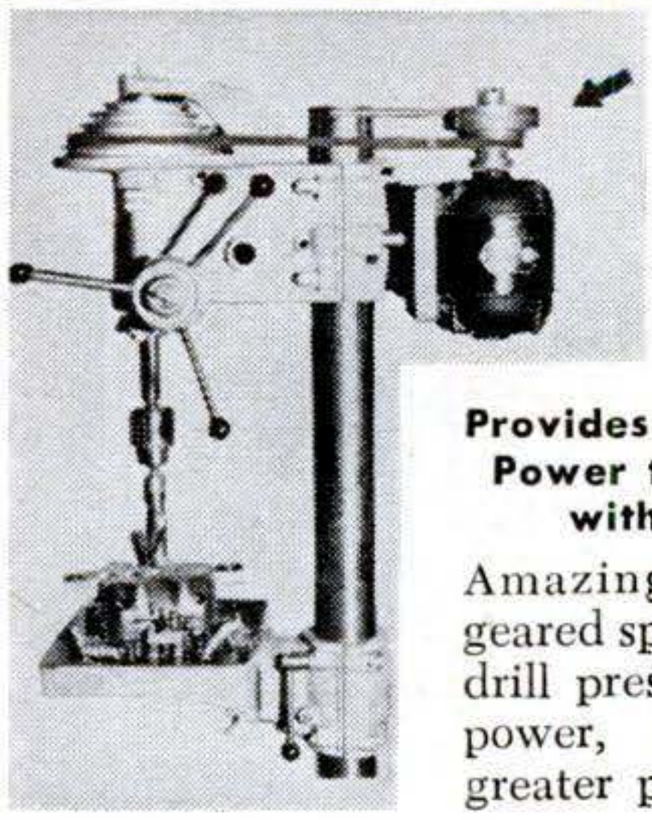
What is it like to ride in a MiniSub? "Like floating on a cloud," Osborn says. "I've flown in light planes and the sensation is the same, except that in the MiniSub everything is quiet, dead still. A MiniSub is a lot easier to learn to fly, too, than an airplane. Anyone can learn in about two hours."

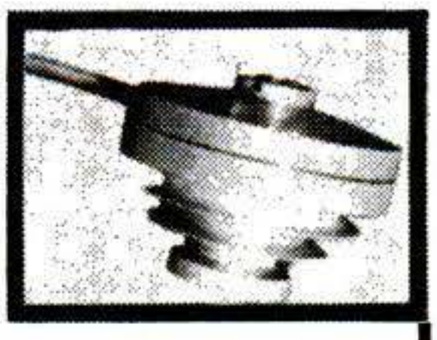
But not all pilot candidates have an easy time of it. Jim Stubstad, Aerojet's current test pilot, recalls the harrowing experience of a Navy frogman he was instructing. He took her across the bay, then cut a number of wild, zigzagging capers in and out of boat-dock pilings on his return. Stubstad stood open-mouthed on shore.

"Congratulations," he called as the frogman climbed from the MiniSub. "I've never seen such a magnificent job of maneuvering."

[*Continued on page 256*]

New "PULL-GEAR" SPEED-REDUCING PULLEY





Provides Correct Speed and Power to Drill Up to 1 3/8" with 1/2 H.P. Motor

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Automatically disengages fan at speeds over 40 mph!

At speeds over 35 MPH, standard automobile fans waste horsepower! The FAN-O-MATIC now makes your fan a free-wheeling unit, releasing wasted horsepower at speeds over 40 MPH.

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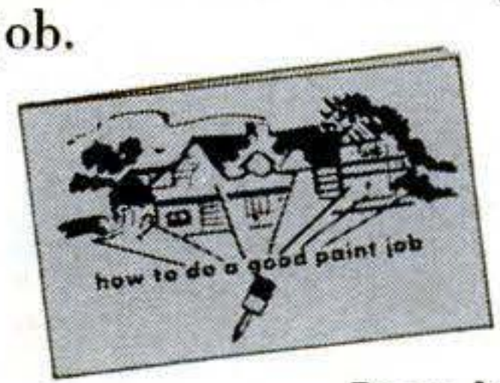

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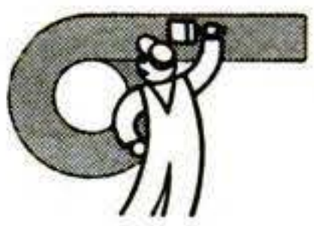

BRUSHES BY
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AMERICA'S FINEST PAINTING TOOLS

Tiny Sub Maneuvers Like a Plane

[Continued from page 254]

"Maneuvering!" cried the indignant and shaken frogman. "The hatch popped open and I couldn't see where I was going."

FORESTALLING such mishaps is the job of two Aerojet engineers, Calvin Gongwer and G. M. McRoberts, who originated the Mark I MiniSub a few years ago in McRoberts' home garage (PS, Aug. '53).

It was nothing more than an eight-foot-long two-by-four with fins, on which the swimmer stretched out prone and pumped a set of bicycle pedals that turned a propeller at the rear. Later, the two-by-four was replaced with a paddle-board, and the swimmer was enclosed in a canopy made of aircraft fabric. Thus was born the Mark II.

By this time, Aerojet had become interested and had taken over construction, under the supervision of Gongwer and McRoberts, now manager and chief engineer of Aerojet's underwater-engine division. The next model, the Mark III, was another one-man job, but substantially changed in that the operator sat upright. Eventually, along came the two-man jobs that interested the Navy—the Mark VI and VII.

Nor is the Navy the only potential customer. Aerojet feels there's a big market among such civilian groups as salvage operators, marine biologists and skin divers. Already, Scripps Institution of Oceanography at La Jolla, Calif., is exploring the depths in a MiniSub.

Most skin divers, however, unless well supplied with greenbacks, would find present prices prohibitive. They range from $4,000 to $8,000, depending on the model and extra equipment.

Aerojet officials say these prices will drop considerably should the company receive large-scale orders. And that could happen if the Navy comes up with a big one.

Navy's frogmen want to go as far, as deep and as fast as possible—and Mini-Sub may be the answer. END

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Want to Hibernate? Slow Down

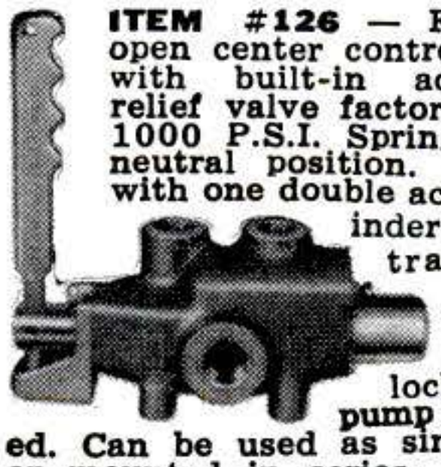
To IMITATE the long winter's snooze of a hibernating animal, Dr. Charles P. Lyman of Harvard says you'd first have to learn the animal's go-slow technique. Using a golden hamster for his laboratory's Rip Van Winkle, the zoologist found that he could put it to sleep any time of year with frigid temperatures, waken it with sunshiny ones. When in the right "frame of mind" for hibernation, its body temperature was near freezing and its blood pressure way down. Its heartbeat slowed to eight, and its respiration to only 10 breaths a minute.

SURPLUS AT FRACTION OF GOV'T COST **TOP VALUE SPECIALS** SHOP BY MAIL AND SAVE AT GROBAN'S

MASTER & SLAVE HYDRAULIC REMOTE CONTROL SET

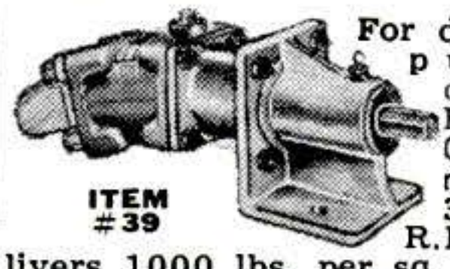
ITEM #415—Designed for remote operation of controls on engines, boats, special machinery, etc. Eliminates complicated mechanical linkages, cables, pulleys, etc. The master unit connects to the slave unit with a single 1/4" tube.
When master control lever is moved, slave lever follows exactly. Light, compact, aluminum alloy construction.
Dim. of both units: 5 1/4" W, 9" H. 1 3/4" D, (exclusive of handle)
Ship. Wt. 8 lbs. F.O.B. Chicago.... **27.50** per pair
(Note—Tubing not supplied)

GROBAN FOUR-WAY OPEN CENTER HYDRAULIC CONTROL VALVE



ITEM #126 — Four-way open center control valve, with built-in adjustable relief valve factory set at 1000 P.S.I. Spring loaded neutral position. For use with one double acting cylinder. In neutral position cylinder is locked and pump unloaded. Can be used as single unit or mounted in series. Has 3/4" pipe thread inlet and outlet. 1/2" pipe thread cylinder ports. Finger grip handle. Ship. wt. 10 1/2 lbs.
AN OUTSTANDING BUY! F.O.B. Chicago **23.50**

VICKERS HYDRAULIC PUMP
PISTON TYPE COMPACT — POWERFUL



ITEM #39

For direct or pulley drive. Rated 8 Gal. per min. at 3750 R.P.M. Delivers 1000 lbs. per sq. in. Ball bearing construction. Standard foot mounting, 1/2" shaft, 1/2" pipe thread ports.
U. S. Air Force cost $136.00
Our low price Postpaid..... **24.95**

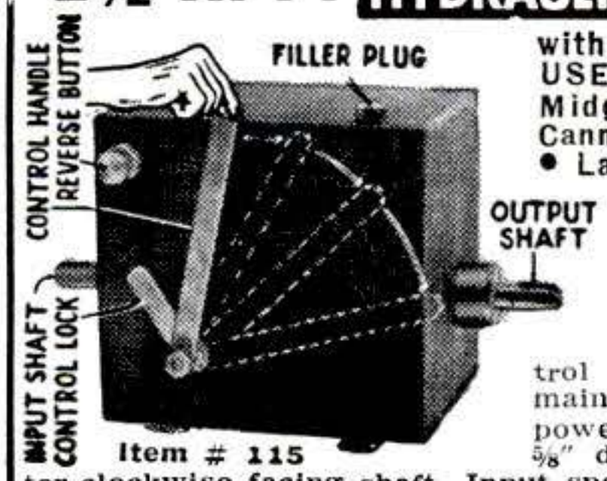
ITEM #1010

BELT DRIVEN A.C. GENERATORS

Ideal for powering electric tools, oil burner, refrigerator, lights, or other appliances requiring up to 1000 watts of power. **1000 WATTS,** 115 Volts, 60 cycles A.C. 3600 R.P.M. Compact, self-regulating generator with V Belt pulley and double outlet receptacle. Rotation counterclockwise. May be driven by tractor or auxiliary gasoline engine. Requires 2 1/2 HP minimum. Dimensions: 10" long x 8" high x 6" wide. Shipping wt. 27 lbs. F.O.B. Chicago..... **79.50**

Model 700—750 WATTS A.C...... **59.50**
Model 2000—2000 WATT A.C. Generator..... **133.00**

1 1/2 H. P. HYDRAULIC SPEED REDUCER



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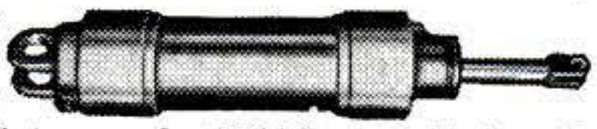
with FINGERTIP CONTROL
USE FOR: • Reamer Drives • Midget Cars • Feed Mills • Canning Machines • Conveyors • Lathes • Milling Machines • Motor Boats • Cream Separators • Garden Tractors • Pumps.
Variable output speeds from 0 to input speed available by moving control handle. Locking handle maintains setting. Use input power of 1/4 to 1 1/2 H.P. Shaft 5/8" diam. Input rotation counter-clockwise facing shaft. Input speed 750 R.P.M. 7 1/2"x7 1/2"x 11 1/2". Output rotation reversible. Shpg. wt. 31 lbs. Complete with 2 qts. of oil and full instructions. F.O.B. Chicago..... **72.50**

DOUBLE ACTION HYDRAULIC CYLINDERS



ITEM #31C — 3 1/2" bore. 11" stroke. Alloy steel cylinder wall. Micro-Honed and all steel 1 1/8" diameter piston rod. 19 1/2" overall length closed. Clevis mounting at base and shaft. Will lift 9625 lbs. with 1000 PSI Pump Pressure. Uses 3/8" tubing fittings. (Fittings to pipe thread: two 3/8" MPT @ 35c.) A $102.00 value. Shipping weight 11 lbs. FOB Chicago..... **25.00**

ITEM #16-C—1 1/2" bore, 26" stroke. Will lift 1760 lbs. with 1000 lbs. pump pressure. Great for hay loaders, etc. 1" stainless steel piston rod. Postpaid..... **16.95**

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U.S. NAVY ALL BRONZE CENTRIFUGAL PUMP

ITEM #384

These all bronze Centrifugal Pumps are ideal for use as marine bilge pumps, circulating pumps, fire protection or irrigation, car-washing, dewatering, basement sump pumping, lawn sprinkling. Will pump water, oil, brine, gasoline, DDT and sulphur compounds. Equipped with 6" adjustable 'V' pulley, 2" dia. inlet and outlet, 180 GPM capacity. Inlet and outlet take hose with 2 1/4" inside diameter. Dimensions: 11" x 8" x 11".

Total head-feet	Speed	H.P.	GPM
25	3600 RPM	3	180
35	3000 RPM	1 1/4	90
20	2400 RPM	1/2	75

Back plate may be rotated for most convenient inlet position. Gov't acquisition cost $96.00. Shipping weight 31 lbs. F.O.B. Chicago..... **29.50**

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ITEM #505 • For house movers, railroads • Construction Equipment • Machinery, rigging.
16-Ton Simplex screw jacks, 1 3/4" x 16", 4-way head type, with malleable iron base, and heat-treated steel handle. Shipping Wt. 35 lbs. F.O.B. Chicago. EA.... **9.50**
Set of 4— $35. F.O.B. Chicago

BRAND NEW 1 H.P. 12 Volt Electric Motor

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• For electric wheel chairs (Pop. Mech. design—Mar.-1953).
• For electric golf carts.
• For self-propelled scooters, children's midget cars.

Rated 1 H.P.,—100 amps., 5600 R.P.M., 12 volts, D.C.—This double shaft motor of ball-bearing construction may be run on 6 volts for lower horsepower requirements.—Standard 5/8" shafts, flange mountings — Dimensions: 9"x4 1/2"x4 1/2". Ship. wt. 19 lbs. A real value at..... **12.50** F.O.B. Chicago

2 H.P. ELECTRIC MOTOR
24 Volts, 90 Amps, 4000 RPM, Spline shaft both ends. Style similar to above. Mfgd. by Hobart or Diehl. ITEM # 315 F.O.B. Chicago. **13.00**

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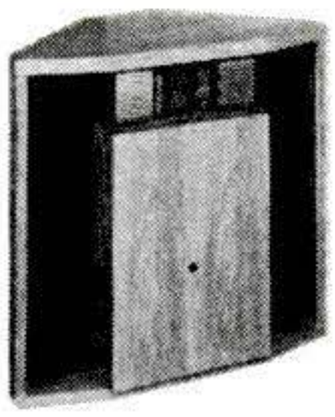
notes and quotes

loudspeaker logic for the newcomer to **high fidelity** *PART I*

advantages of a system made with components

"High Fidelity" is a phrase invented by sound lovers who were determined to find a better way of reproducing music in their homes. They found equipment which would accomplish this in the small establishments of sound specialists who were making precision reproduction equipment primarily for the motion picture and broadcasting industries.



The very best loudspeaker system — The Hartsfield

Today there are two kinds of high fidelity. The first kind is the music system assembled from specialist-built *components*. The second is the ordinary, packaged, complete radio-phonograph to which the term "high fidelity" is indiscriminately attached as a merchandising slogan. Since the second kind appropriates the words from the first, we shall call the original, component type, "true high fidelity".

The components in a true high fidelity system will consist of a loudspeaker system, power amplifier, preamplifier-control unit, and sound sources. The source components may be of any of the following: FM and AM radio tuners, record changer or player, tape machine, television chassis.

The advantages to owning a music system made up of components are: 1. You get better quality sound for less money. 2. You can balance the quality of components. 3. You can continue to improve upon your system. 4. The system you select will exactly match your individual needs.

JBL Signature loudspeakers are true high fidelity components made by James B. Lansing Sound, Inc., a manufacturing concern which devotes all of its energy and resources to making the very best loudspeakers possible. JBL Signature speakers are made with the care and precision usually associated only with the manufacture of scientific instruments. Components of this quality are only available for use with true high fidelity systems. They are demonstrated and sold by dealers who *specialize* in audio components. There is a JBL Signature speaker for every purpose. They range from the beautiful, small, Model D208 eight-inch extended range unit to the mighty Hartsfield, a complete speaker system built around JBL Signature Theater Speakers. Write for your free catalog and the name of the audio specialist in your community.

every note a perfect quote

"JBL" means

JBL JAMES B. LANSING SOUND, INC.

2439 FLETCHER DRIVE, LOS ANGELES 39, CALIF.

[*Continued from page 70*]

fornia desert, a year ago. While my car was being gassed in a temperature of 112 degrees, I stepped into a small, air-conditioned restaurant. It was like Paradise.

"What's the temperature in here?" I asked the waitress.

She consulted a thermometer. "Ninety," she said.

The goal of the car-refrigeration engineers is a "cool-down" from an inside temperature of 100 degrees in a 100-degree ambient to 75 degrees at "breath level" in five minutes at a car speed of 30 miles an hour under a full sun load. They haven't reached it yet, but they're close.

Today's air conditioners—excluding the water-evaporative type that works well only under low-humidity conditions—use a gas as refrigerant. The gas, dichlorodifluoromethane, which goes by the trade name of Freon 12, can be liquefied. It's used because, as a liquid, it boils many degrees below zero Fahrenheit at atmospheric pressure.

In the car, it is put under high pressure by a pump, or compressor. Then it is run through a condenser in front of the engine radiator. The cooling flow of air liquefies it. Released to an evaporator through a pressure-reducing expansion valve placed athwart the stream of air supplying the passenger compartment, it boils.

Like water, Freon liquid requires heat to become a vapor. It gets much of this heat from the air going through the evaporator. Result: cool air. It's also drier air—when air is chilled, it sacrifices some of its capacity to retain moisture. The moisture is deposited on the evaporator's cooling coils and runs out a drain.

Leaving the evaporator, the Freon gas returns to the compressor, completing the cycle.

Except for the addition of a blower to circulate the air, the essential parts of a car air conditioner are exactly those in a home refrigerator—a pump, a valve and

[***Continued on page 260***]

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Coming in June Popular Science:

HOW TO BUY A 1957 ROOM AIR CONDITIONER

EVERYTHING you need to know to make a smart buy—that's what you'll get in June POPULAR SCIENCE's giant Consumer Service Report on 1957 room air conditioners. You'll learn how to pick the right unit for your room. And you'll get a complete breakdown of specifications for every unit—price, efficiency in terms of operating cost, BTU capacity, fan speeds and capacity, types of filters, dimensions, cabinet materials and lots more. Be sure to see this special June POPULAR SCIENCE feature—it will guide you to the best buy for your needs and your budget!

Also in June Popular Science:

REPORT ON FOREIGN FAMILY CARS UNDER $2,500

A colorful six-page feature that delivers the straight goods on over a score of small, low-priced foreign cars on the U. S. market for family use. A two-page specifications chart reveals price, top speed, miles per gallon, horsepower, bore, stroke, displacement, and other facts you'll want to know. Get all the exciting details in June POPULAR SCIENCE!

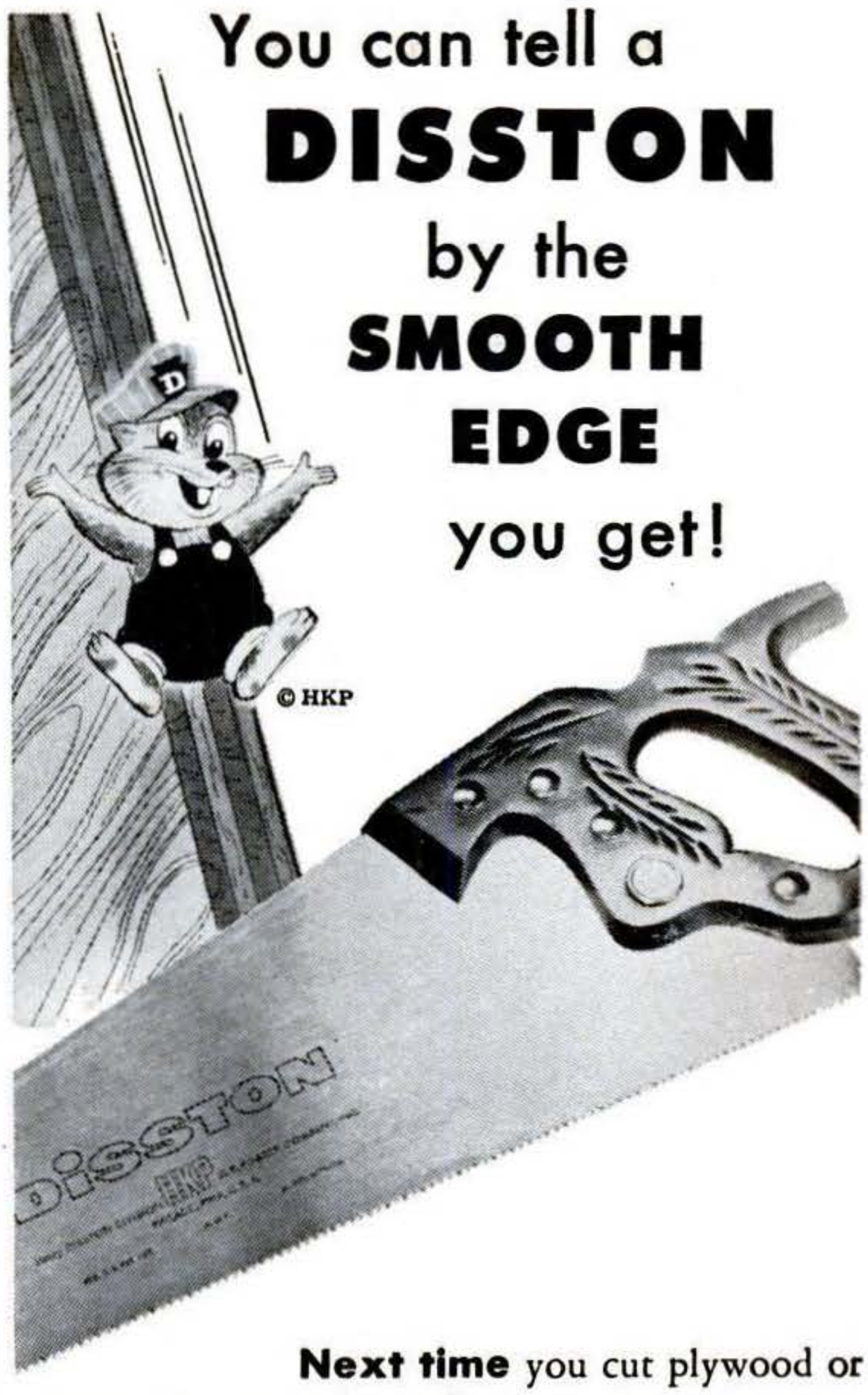
HOW TO TAKE CARE OF YOUR '57 FORD

Six picture-packed pages on proper maintenance of all '57 Ford cars! Step-by-step photos and details show how to adjust brakes, carburetor, point opening, valve clearance, how to add transmission and brake fluid, clean the air cleaner, plenty more. Get a master mechanic's know-how in June POPULAR SCIENCE!

HOW YOU CAN SELL YOUR HOUSE AT A PROFIT

A real eye-opener on what your house *should* and *should not* have if you want to sell it at a profit. See how certain improvements can actually cause you to take a loss—how other improvements will more than pay for themselves when you sell. This June POPULAR SCIENCE feature can earn you hundreds, even thousands, of extra dollars when you're ready to sell your house!

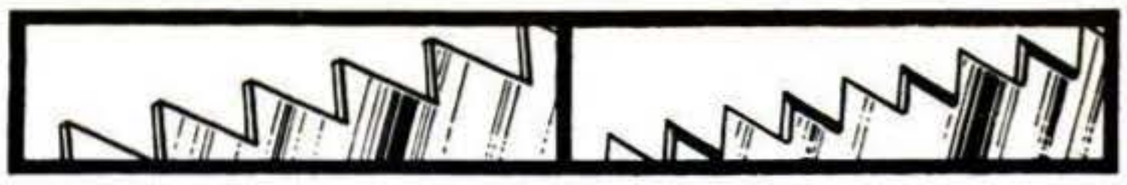
Get June Popular Science —at all newsstands, soon!



You can tell a DISSTON by the SMOOTH EDGE you get!

Next time you cut plywood or other well-seasoned woods, use a 10-, 11- or 12-point Disston Hand Saw. Note how easily it cuts . . . what a beautifully smooth finished edge it leaves! That's because these fine-toothed saws are specifically designed for finishing work. Made of fine tool steel, with perfectly tempered and double taper ground blade, Disston Saws give years and years of service, too.

At better hardware dealers... everywhere!



Choose a 5½-point Disston Hand Saw for cutting with the grain.

Choose a 7-, 8- or 9-point Disston Hand Saw for cutting across the grain.

FREE ILLUSTRATED BOOKLET! 64-page Disston Saw, Tool & File Manual. Tells how to choose and use tools; how to care for them. Helpful hints on wood and metal working, and selection of materials. For your free copy write today to: *Henry Disston Division, H. K. Porter Company, Inc., Philadelphia 35, Pa.*

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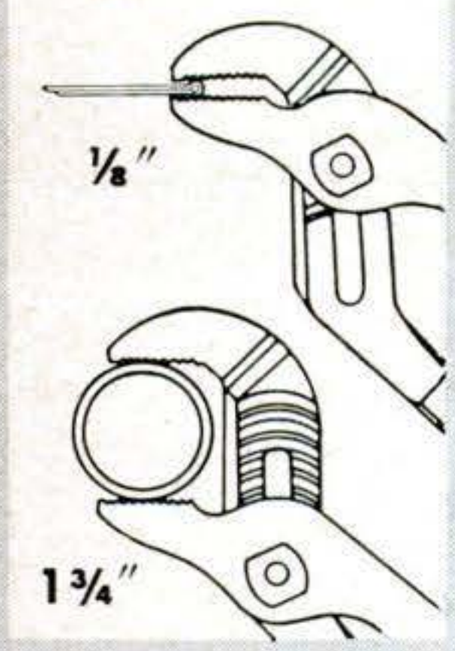
No. 420

GRIPS LIKE A PIPE WRENCH



No other plier does so many jobs so well as a Channellock No. 420. Grips anything from a small cotter pin to a 1¾" hex nut. And what a grip! Just like a pipe wrench. What's more, Channellocks are streamlined . . . easy to use in hard-to-get-at places. Ask your hardware man for a Channellock plier. You'll soon agree with thousands of other craftsmen . . . Channellock is the handiest plier of them all.

BE SURE IT'S A GENUINE CHANNELLOCK

CHAMPION DEARMENT TOOL CO. MEADVILLE, PA.

[Continued from page 258]

two heat exchangers. It's that simple.

And right there the simplicity ends. A car air conditioner must:

- Cool a compartment that is a rolling greenhouse, relatively uninsulated.
- Be able to cool up to six passengers and change the air up to twice a minute without objectionable draft—in only 120 cubic feet of space.
- Employ a compressor able to take a speed range of 500 to 5,000 r.p.m.
- Withstand temperatures from 120 degrees to sub-zero.
- Be compact and light.

The engineers had to produce tidy-size compressor-condenser units with ratings half again as big as those used to air-condition rooms containing 10 times as much cubage as a car.

Another problem: An automobile air conditioner quarrels with the engine-cooling system. Because there was no obvious alternative, the engineers put the condenser in front of the radiator. The interference with the air flow, plus the heat imparted to the air in passing through the condenser, made the engine get too hot. This necessitated changing the pitch of the fans, or the number of blades, or both. In some systems the fans were shrouded for a venturi effect. More copper was put in radiator cores for better heat transfer, and the cores deepened. Higher-pressure caps were put on radiators to raise the boiling point.

Expansion valves had to be designed to keep the Freon at a high enough level in the evaporator to do its work, but not so high as to let liquid Freon reach the compressor and damage it.

The temperature of the evaporator coils could not go below 33 degrees. Otherwise, moisture condensing from the air passing through it would freeze and clog it. The engineers met this problem in one of two ways—by thermostatically sensing the temperature and switching off the compressor, or by sensing the pressure and bypassing the gas past the evaporator and condenser.

[Continued on page 262]

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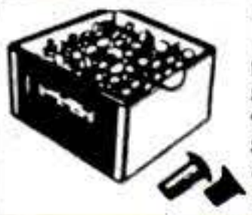
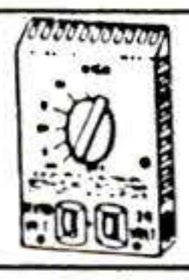


DUPONT EXPLOSIVE RIVETS! A must for the man who works with sheet metal. A hot soldering iron placed on the head of the rivet will explode and mushroom the other end of the rivet self-bucking itself. 1/8" - 5/32" - 3/16". Round and flat heads. Approx. GOVT. COST $50.00 a 1,000. NEW. 1,000 assorted, **$5.00** ppd.

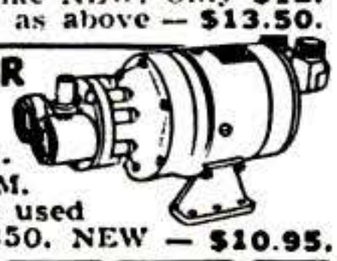
FAMOUS B-16 KOLLSMAN AIRCRAFT COMPASS
Finest compass ever made. For use on planes, boats, cars, trucks. In current use on small & large aircraft. Can be hand carried on expeditions, weighs 1½ lbs. Graduated in 5° increments. Liquid filled, lighted, poly-plane compensator. Panel mounting, 3⅛" dia. face, 4½" in depth. Like NEW. Approx. GOVT. COST $150. Only **$13.95** ppd.

HEAVY-DUTY RHEOSTAT Designed for heavy-duty use with Air Force heated suits. Ideal for regulating voltage on electric welders, model trains, lights, generators; controls soldering irons, etc. Rated 5.75 ohms, 100 watts with double windings and dual female 25 amp. 125 volt receptacles. Size: 7" H x 5¼" W x 1¾" D. Shpg. Wt. 2½ lbs. Approx. GOVT. COST $25. Brand new, only **$1.95.**



140-1 REDUCTION GEAR Make your own winches, hoists, wagon unloaders, stump pullers or fence stretcher. Sturdy aircraft quality. Built-in (removable) 24 Volt DC motor & clutch. High torque. Low speed. 100's of uses. Wt. 42 lbs. Approx. GOVT. COST $300. Like NEW. Only **$12.** *225-1 Reduction Gear, same as above — **$13.50.**

BENDIX PUMP & MOTOR
Can be used for pumping fuel, oil or wherever hydraulic pressure is required. Pump has 1" connections, built-in relief valve, adjustable up to 1500 lbs. Max. capacity 6 GPM. 1½ H.P., 24 volt motor, 4000 RPM. Can be used on 12 to 36 volts. Approx. GOVT. COST $350. NEW — **$10.95.**



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Complete Kit $39.95
Kit consists of: 1 Famous Navy NEA-5 Generator. New! Combination AC-DC Type. AC voltage—115 V. DC voltage—24 V. 200-300 Amps. 2 complete generators in 1 . . . 2 separate fields & 2 separate armatures on same shaft yet no larger than reg. aircraft generator. Ideal for home, farm & shop lighting plants by hooking wires to AC side which will give 1200 watts. DC side can be used for charging batteries, welding & operating war surplus low voltage hobby motors & equipment. Also in kit: 1 Voltage Regulator DC. 1 Voltage Regulator AC. 1 Reverse Current Relay. 1 Ammeter and Shunt. 1 Voltmeter, 0 to 30 Volts. 1 Rheostat. 1 Electrode Holder. 1 Giant Toggle Switch. Welder's Shield. Wiring diagram for hookup as welder. Wt. under 100 lbs. Approx. GOVT. COST $600. Kit, **$39.95.**
Navy NEA-5 Generator (only) — same as above . . . if purchased separately: $27.50.

R1 GENERATOR KIT Jack & Heintz or GE. Rated 300 Amps. 24-32 Volts. With same items as above incl. 300 Amp Ammeter. Approx. GOVT. COST for kit $600. Complete kit only **$39.95.** Wt. 60 lbs.

LONG FLUTE, HIGH SPEED DRILLS
20 assorted, numbers & fractions. Like NEW. Approx. GOVT. COST $30. Only **$3.00** ppd.

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Use the postcard on page 187

NEW! 115-AC from any Truck or Tractor with the ELECTROL GENERAC

- **MODEL CD 3500 —** 3500 Heavy Duty Watts; 60-Cycle, 115-230 Volts.
- **MODEL 1500 —** 1500 Watts; 60-Cycle 115 Volts.

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COMPLETE WITH MOUNTING BRACKET—BELT—PULLEY

The Electrol GenerAC produces 115-AC power for operating drills, grinders, sanders, circle saws and other tools. It serves many industrial and farm purposes as well as emergency uses to keep freezers, milking machines and bulk milk coolers operating during power failures. An ideal auxiliary power source for building contractors' trucks, garage repair trucks, electric, gas and telephone service trucks. Write—state make and model of truck or tractor on which it is to be installed.

ENGINE GENERATORS
115-230 volts — sizes up to 2500 watts, also available.

Electric Controls, Inc.
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Dealer Inquiries Invited

A PRECISION LEVELING INSTRUMENT for only $12.95

—better than any transit!

"When it comes to accuracy, the Levelall is better than any transit," writes Mr. Richard S. Otto. The New LEVELALL is a 75′ transparent plastic tube with shutoff valves, mounting brackets and filled with a special, colored anti-freeze liquid — a precision leveling instrument.

One man can do the work of two men and a transit, quickly, easily, accurately. With Levelall you can, without help, speedily level points for footings, forms, piping, batter boards, sills, lintels, floors, ceilings, masonry, roads, driveways, lawns — any type of construction work.

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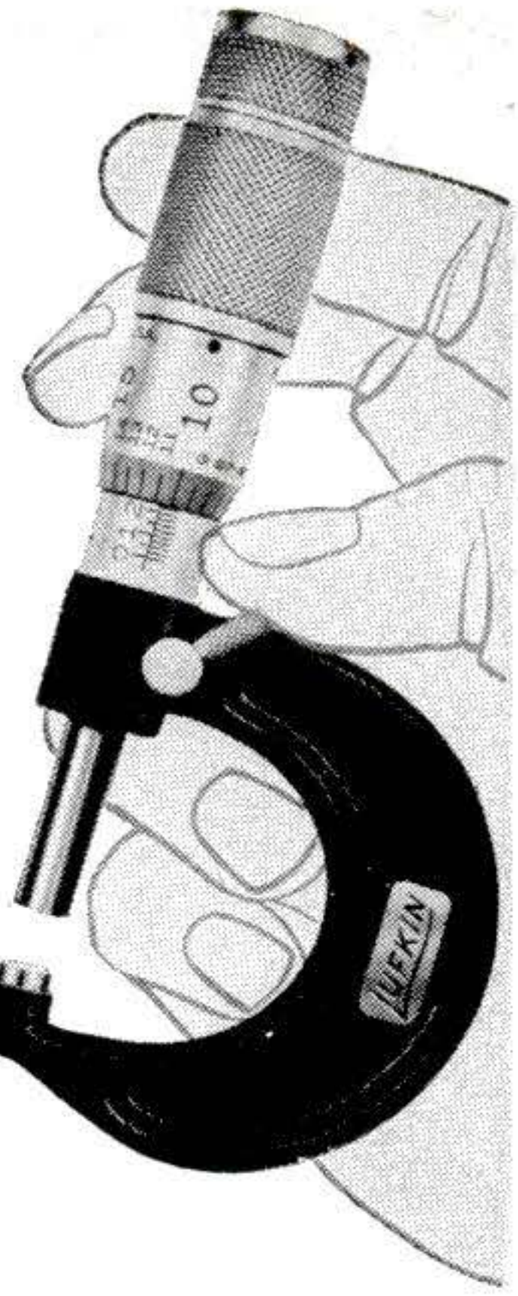
With NEW CAM LOCK



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Now, you can lock faster, more securely with just a flick of the thumb. This new cam-action lock positively secures the thimble from movement until the reading is made or transferred. An exclusive new feature, available only on Lufkin Big Barrel Micrometers.

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$4.95 Tube for most cars

does help in 6 important ways

1 - reduces oil consumption
2 - restores compression
3 - stops piston slap
4 - increases miles per gallon
5 - improves performance
6 - makes engine quieter

20 years on the market. No one else can claim this. Effective interim treatment for worn cylinders. Forms self-lubricating seal around pistons. Lasts for thousands of miles. Get yours NOW. Delay is costly.

Ask for Piston Seal at nearest garage or auto store . . . or

TREGLOWN CO., Inc.
Fanwood 127, N. J.

Write for full details

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What's New in Car Air Conditioning

[Continued from page 260]

To turn the compressor on and off, not only to control the evaporator temperature but also to energize the air-conditioning system in its entirety, the engineers adopted a friction clutch. Responding to a manual switch or thermostat, a magnetic coil engages or separates the clutch faces inside the pulley which engages the compressor. With compressor disengaged, the engine is left spinning only the pulley. The power loss is microscopic.

In the bypass version, the compressor runs continuously while the air-conditioner switch is on. Electric or pressure-operated circuits that open and close automatically operate gates in the plumbing for the full compressor-condenser-evaporator cycle or for the bypass.

Pioneer work on car air conditioning was done by independent manufacturers, largely located on the sun-baked Texas plains. These enterprising fellows, picking up where Packard and other automobile companies left off after a brave but abortive attempt at air conditioning in 1939, began building conditioners from hardware-store components at the close of World War II. Their units, refined in the last 10 years but less sophisticated than those engineered by Detroit, still do a job.

The independents remain very much in business today. Last year they sold 77,000 conditioners—not too far under half of Detroit's 170,000.

Giant strides toward simplicity of installation have been made. Only four years ago, just putting a conditioner in a car accounted for half the cost. Now Ford Motor, GM and the Chrysler Corporation are installing the things right on the regular assembly lines.

Meantime, some other chaps have been at work on more mundane air-conditioning problems. For those systems that recirculate most of the air continuously—and pick up odors—you can get a deodorizer. Just clip it inside the evaporator. Same thing that you buy at the supermarket for the home. END

NEW! DISCOVERY!

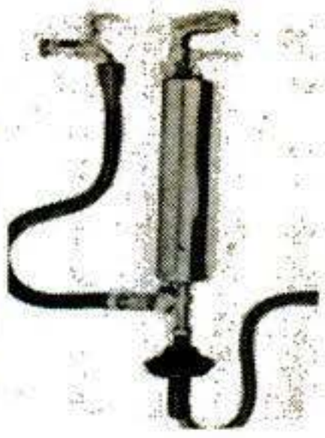
SAVES PLUMBING BILLS

OPENS DRAINS INSTANTLY

Chicago, May 1st—Home Owners, Offices, Apartments, including Factories are constantly having trouble with clogged-up pipes which proves expensive in Costly Plumbing Bills—
But now—using Water Impact and Air Pressure here is a new unit called the **Plumber's Flushing Gun,** which cleans all lines up to 100 ft. It will open any number of bends in pipe. Yet anyone can operate this new gun which triggers easily.
TOILETS, URINALS, SINKS, and FLOOR DRAINS clogged with paper, grease, rags, sand, and other debris can be cleared with one or more shots from the gun, **saving the owner, the Gun's price the first time it is used.** This new Flushing Gun may be used on any ½ to 6 inch pipe including Bathtubs, Hot Water Pipes, Septic Tanks, and House-to-Street Sewers. Obstructions melt away INSTANTLY when struck by the hammer like blow of this new unit.
This new Flushing Gun is offered on 30 Days Free Trial. BUT MOST IMPORTANT IS THIS. What is this Tool worth in **Costly Plumbing Bills Saved** in your Home or building? For your own good—Tear this Ad out now and write your name and address beside Ad for **Free Booklet.** No Agent will call—Obey that urge. We also make Electric Sewer Rodders (Chicago Phone Kildare 5-1702) **MILLER SEWER TOOLS, Dept. PS-4, 4642 N. Central Ave., Chicago 30, Ill.**

AMAZINGLY EFFECTIVE

Hose attachment feeds water thru gun while air is released causing chain reaction in pipe cleaning the most stubborn stoppage. No need to remove wall or pipe.



★ SCIENTIFIC PRINCIPLE!

Water Impact creates "Kinetic Energy" (Static Waves in Water). This Force is 98% forward and only 2% against pipe eliminating any danger to fixtures. Vents or stacks are no obstacle as force tends to strike at point of greatest resistances. Here's great news for anyone who has ever paid out a Costly Plumbing Bill—Phone Kildare 5-1702—or write now for Free Booklet.

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ELECTRIC WATER PUMP

● Hi-capacity, small centrifugal. Operates on 6-12 or 24v AC or DC. Excellent bilge-sump pump; circulating water display; cellar drain, etc. Ball bearing explosion-proof motor 6 to 15 gal. per minute. Outlet 1" O.D. 7" high, 3" diam. Govt. cost $64. SALE, **$12.95** Ppd.

DUAL RATIO, BATTERY GEAR MOTOR

● Powerful ball-bearing reversible gear reduction motor. Operates on 6 or 12-v batteries. Has 2 output shafts. Shaft #1, 80 to 1 reduction. Shaft #2, 40 to 1 reduction. Precision machined steel gears.
● Use for children's autos, winches, elevators, garage door closers, etc. Available r.p.m. at 6v, 60 and 120; at 12v, 124 and 248.
● Shafts 5/8" and 3/4" diam. Overall dim. 5½"x9"x12". Net wt. 19 lbs.
Cost Govt. $145. SALE.....**$14.50** F.O.B.

ELECTRIC WINCH 6-12-V DC

● Powerful, fully reversible, all ball-bearing gear reduction winch. Runs from car, truck or boat battery.
● Load capacity 1000-lbs. at 6v, 2000-lbs. at 12v. Holds 40' of ¼" cable. Cable speed 8 to 10 ft. per min.
● Cuts truck loading time in half. For wagon dumps, machinery hoist, on jeeps, cars to pull out of mud, etc. Dim. 7"x9"x17½". Net wt. 49 lbs. Govt. cost $280. SALE **$46.75** F.O.B.

CONTRACTOR-FARMER LEVELS

● Precision instruments, achromatic optics. Ideal for leveling, contouring, foundation construction, etc. Each complete with tripod, rod, target, case, instructions.
● No. 1 Level. Popular slide focus model. SALE .....**$47.00** Ppd.
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IRRIGATION PUMPS

2½" Size, 16,500 gph

● Brand new, bronze, ball bearing. Wonderful farm, contractor, industry pump.
● Capacity to 280 g.p.m. Pressure to 65'. Speed 2100-2700. Clockwise rotation. Complete with 6" pulley. Wt. 40 lbs. Size 10"x11"x9". Inlet 2½", outlet 2". Nat'l. Adv. List $98.00 SALE.....**$39.95** FOB.
2" hose, 2½" plastic pipe available (Write.)

HYDRAULIC BARGAINS

● Special purchase! Brand new hydraulic cylinder, 3½" bore, 24" stroke, single acting. 9621 lbs. push. Rod diam. 1⅜". List price $45.95. SALE.....**$27.95** F.O.B.
● 2-way Cyl. 3" bore, 6" stroke, Ppd. **$14.95**
● Hyd. Valve for 1 & 2-way cyl. Ppd. **$12.95**
● Hyd. Pump, 1000 psi 12 g.p.m. Ppd. **$45.50**
● Hyd. Gauge. 1000, 1500, 3000 psi (Specify).....Ppd. **$3.49**
Many hydraulic bargains in catalog.

SPECIAL OF THE MONTH!

CENTRIFUGAL BLOWER with BUILT-IN MOTOR

● Brand new, motor and blower in a single self-contained unit. Ideal for heating, ventilating and air conditioning uses.
● 115-v, 60-c motor integral mounted with double inlet blower wheel. Displaces 725 cfm at 800 rpm. 7" diameter blower wheel. Outlet 7⅞"x9¼". Overall dim. 13"x10½"x12½". Wt. 23 lbs. List price $40.75. SALE.....**$24.95** F.O.B.

ARMY POWER PLANTS

Amazing buys. Fully guaranteed.
● 1000-w, 115-v, 60-c **$179.50** Ppd
● 2000-w, 115-v, 60-c **269.95** Ppd
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● G.E. Generator 3000-w, 115v, DC. Fine for portable tools **49.71** F.O.B.
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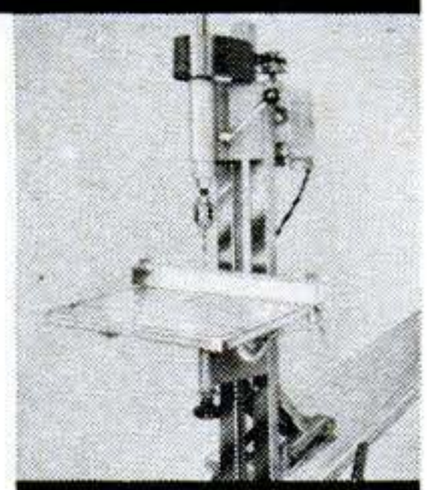

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For Knives, Scissors, Tools

*Zax: a tool for cutting and punching shingles.

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Manufactured by E. F. Britten & Co., Cranford 4, N. J.

These Cameras Make Time Stand Still

[Continued from page 82]

T. Off comes the canopy like the tipping of a hat. And out flies the dummy, but slowly this time. Quickly, Enbody spots the trouble: failure of a tiny metal finger to reach out and strike the activator that should set off the explosive charge that separates the catapulted dummy from the seat.

"These cameras tell us things we'd never discover, except perhaps by hit and miss," Enbody says. "And we can't afford to miss very often—not when sled runs cost in the neighborhood of $25,000 and up."

Engineers at Northrop Aircraft are almost entirely dependent on high-speed cameras in wind-tunnel tests, where experiments include the jettisoning of emptied wing-tip fuel tanks from models of airplanes.

"As these tanks come off, they go through some strange gyrations," says Roy Wolford, superintendent of photography. "They sometimes poke holes in the wing, or slide along underneath and rip into the fuselage. Sometimes they fall back and smash into the planes tail section.

"The cameras tell us what happens at various air speeds and flight angles."

TO RECORD many of the tip-tank drops, Cecil Berthold, superintendent of North American's wind-tunnel operations, shoots an Eastman at 3,000 frames per second.

"Originally," he says, "airplanes were equipped with free-drop tanks. That is, they were released and fell of their own weight when empty. But with the new, faster aircraft, we have to incorporate an explosive charge that forces them downward and away. Jettisoning became a problem when we reached Mach I."

Engineers began crying for fast cameras after the coming of the jet and missile age. And suddenly there was a mad rush for the war-surplus stores to buy up the old GSAP (Gunsight Aiming Point) cameras that recorded gunfire from air-

[Continued on page 266]

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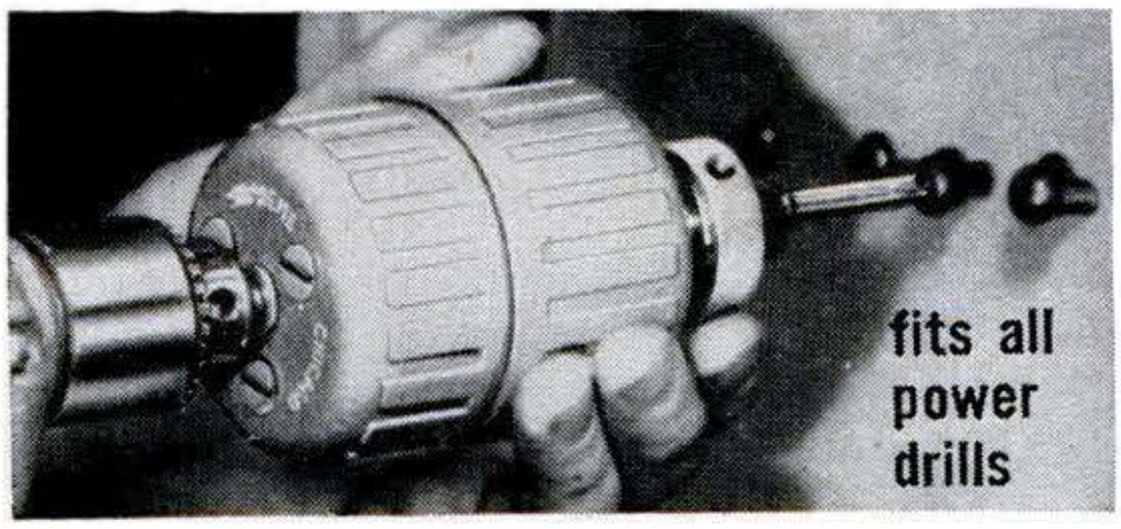
SUPREME

Versamatic

REVERSIBLE SCREW DRIVER AND SPEED REDUCER



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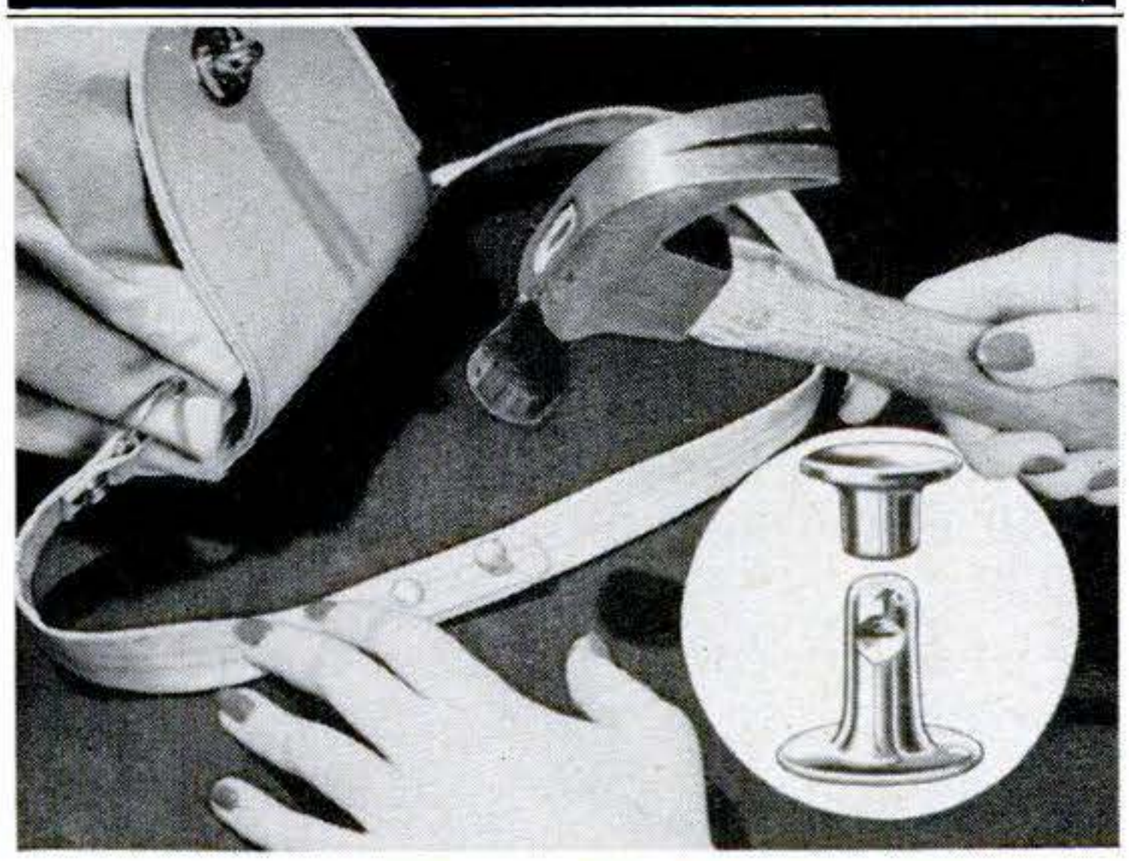

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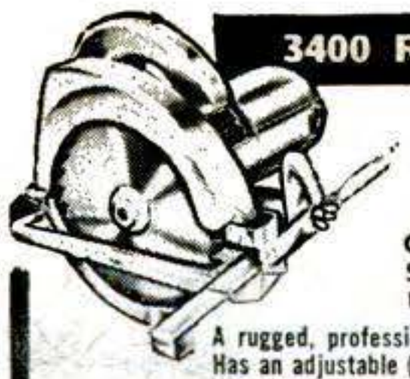

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COMPARES TO SAWS SELLING UP TO $49.50 — 19.98 — Complete with 5-1/2" Blade

A rugged, professional type, adjustable saw. Will cut any angle from 0 to 45°. Has an adjustable (0 to 6") rip fence. Safety-trigger switch on handle. Full ½ HP Universal AC-DC, 110-120 Volt, 60 cycle motor. Weighs only 6½ lbs.

EXTRA SAW BLADES — Available in Rip, Crosscut or Combination. Please Specify 2.25 EA.

NEW POWER SAW BENCH TABLE

This sturdy, precision made bench-saw table converts our famous Power Saw (above) to a handy, versatile table-saw. Comes with a rip fence and mitre guide that permits accurate rip, cross, angle or bevel cuts. Saw is easily and quickly installed. Table size: 14"x 16"x 6" high. NOW ONLY 9.95

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For Paneling Dens, Offices, etc. Use in Cabinets, Furniture, etc. Rotary cut. Both sides sanded. Bonded with the finest resin adhesive. Face side unjointed. Shipped at lowest, truck rates.

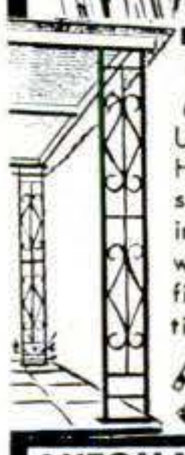
3MM(1/8") x 3FT. x 6FT. $5.00 VALUE — 1.79 PER SHEET — MINIMUM ORDER 8 SHEETS

FREE SAMPLE ON REQUEST

1/4" x 4FT. x 8FT. 9.50 VAL. — MIN. ORDER 4 SHEETS — 4.49 PER SHEET

SAVE 50% ON TRANSLUCENT FIBERGLAS PANELS

Finest quality. Available in many widths and lengths. Excellent color selection. Ideal for home, office, etc. FREE sample and booklet. 49¢ SQ. FT. 85¢ VAL.



HEAVY WROUGHT IRON PATIO SUPPORTS

Use them indoors or outdoors! Heavy 1-1/8", black tubular supports with beautiful wrought iron filigree. 8 ft., high, 12" wide. Can be cut to 7 ft. You'll find many uses for this attractive item. Mtg. flanges included.

FLAT TYPE .99.5
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85 TO 1 GEAR BOX

For use where a tremendous power at a low take-off speed is desired. Drives thru a train of 6 gears rotating on self-lubricating, high speed roller bearings. Take-off shafts are 1-1/4" and 3/8". . . . NEW – in top condition. . . 5.95 USED 8.95

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ADAPTS TO
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TV or BEAM ANTENNA ROTORS
AUTOMATIC DOOR OPENER
REMOTE MACHINERY CONTROL

Has 1/20HP, 24V DC., 2270 RPM, continuous duty motor. Gear box reduction is 133–1. Take-off speed 17 rpm. $22.50

SPECIAL AIR PRESSURE TANKS

G-1 Type. Stainless Steel. Shatterproof and rustless. Built to withstand up to 400 PSI with high safety factor. Has 1/4" pipe ports. Ideal for use in Air Storage for painting, spraying, etc. Can also be used for water storage, as a buoy, etc. Size: 12½" diam. x 24" length. . . . .

NEW and UNUSED 16.95 USED 12.95

2500 lb. LIFT HOIST

Ideal for garage, boat, jeep, truck, shop, etc. Has bronze worm gear drive with 24 to 1 ratio and 3-speed crank. Comes with 18 ft. of 3/16" high tensile steel cable and crank, and free-spool, pull-out clutch. . . 34.95

HOIST MOUNTING FRAME – Ideal for above hoist 4.50

LARGE VOLUME Stainless Steel AIR or CHEMICAL STORAGE TANK

J-1 Type. 18,000 cu. in. capacity or 77 gallons. 24" diam. x 45" length. Modified for use with air. Will stand pressure up to 400 PSI. 99.95

ARMY PICMATTOCK

Has 12" steel head with Mattock on one side pick on the other. 16½" hardwood handle. 1.29

PORTABLE SHOVEL & CASE

G.I. Surplus. 20" handle. Blade folds to form pick. Carry in car for emergency ONLY 1.79

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[Continued from page 264]

craft during World War II. After the war, they were sold for a few dollars a pound, but new demands by engineers skyrocketed the prices to $300.

The GSAP, firing at 64 frames a second, was modified to shoot up to 150-200 frames a second. Still, it wasn't fast enough. Besides, the heavy G loads on missile flights caused jams in the film mechanism.

At this point such people as Wollensak, Fairchild, Eastman, and Bell & Howell began turning out new high-speed jobs. Some are small—about shoebox length. For space is dear inside a missile.

TERRIFIC G force, vibration, heat and cold punish these new cameras that ride the missiles. Therefore they are being put to incredible tests. Wollensak claims its new Fastair, shooting at 600 frames per second, will operate at 100 G's. Fairchild boasts that a new model will perform at acceleration of 200 G's.

"In testing one of our new cameras," says Lee Weeks, Wollensak representative, "Lockheed baked hell out of it, froze it, shook it to death and spun it like mad on a centrifuge."

Glenn E. Miller, chief of Lockheed's missile motion-picture department, fires expensive, steel-jacketed cameras against a concrete wall. He does this with a giant slingshot composed of two heavy posts anchored in the ground.

"This seems mad to someone who doesn't understand," says Miller. "But we've got to be certain these cameras will operate under any conditions."

With the ordinary movie camera, the film stops and the shutter opens to take each picture. But film in the high-speed camera moves continuously. And instead of shutters there are rotating glass prisms, with either four or eight facets, that capture the image and transfer it onto the film.

There is one amazing camera, built by Beckman-Whitley, that takes pictures at the incredible rate of 4½ million frames a second. The image is caught on a metal mirror revolving 18,000 times per second, then is hurled into as many as 50 lens sets, arranged in an arc around the mirror. However, this camera is for very special research, such as in university laboratories, and is not a missile winker.

Aircraft and missile builders are spending millions to keep their cameras grinding. One small company alone averages $500,000 annually. At North American's Rocketdyne division near San Fernando Valley, high-speed cameras devour some 40 miles of film a month. To project this at normal speed would take 150 hours. That's the equivalent of 100 full-length feature films a month.

Both black-and-white and color film are used in the speed cameras. Color is preferred because it separates spectrum phenomena, such as different colors resulting from the burning of various metals.

WHAT'S riding a missile like? Robert M. Betty, chief of Lockheed's optical-instrumentation group, gives this dramatic comparison of the environmental encounters of a missile in flight, camera tucked tightly in its belly:

"In some instances the vibration is such that it would tear the rivets out of the chassis of your automobile and remove the cylinder head without the help of a wrench.

"The temperature would melt all the solder connections in your TV set, boil away all the thermoplastics and reduce to cinder all insulation in the wiring.

"The shock loads would wrench the engine out of your car, taking the radiator and grille with it. The lower temperatures would freeze all lubricants, including your crankcase, into one solid block."

That's what the speed camera's ride is like. Yet it grinds on faithfully, turning split seconds into long minutes that reenact the life—or death—of a missile.—*Jerry Hulse.*

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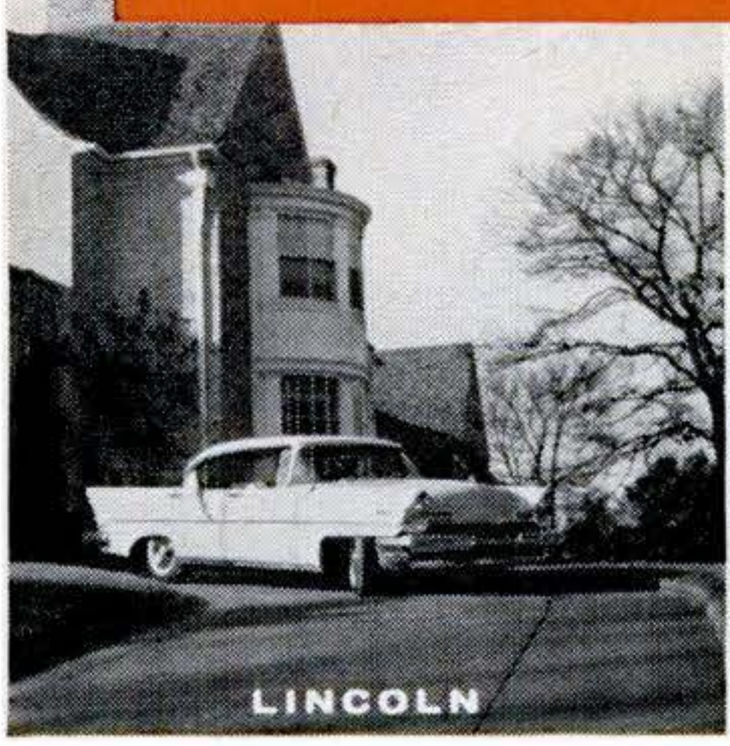


Some spark plugs are designed for high speeds, some spark plugs are designed for low speeds, but . . .

AUTO-LITE POWER TIP "fires up" Ford Motor Company cars at all speeds!

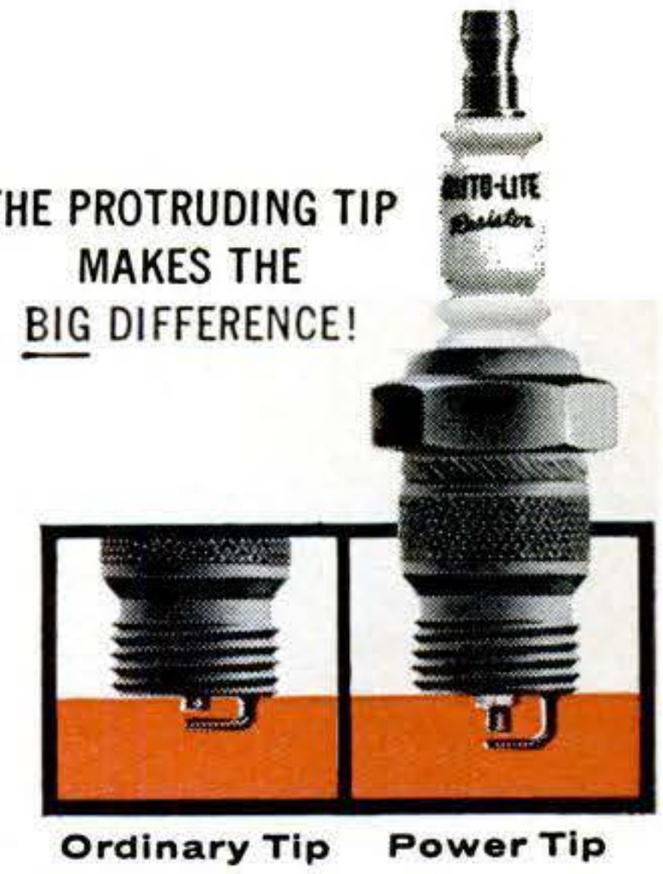
The first spark plug ignition-engineered for today's engines* and today's driving

Today's higher-horsepower, higher-compression engines and today's driving demand *more* from spark plugs, and Power Tip *gives* more! Performance tests prove Power Tip "fires up" engines of Ford Motor Company cars for top performance and economy at *all speeds!* Here's why...

At *low* speeds, the projecting Power Tip gets hot *fast*, operates hotter to burn away fouling deposits which impair engine performance in city driving. At *high* speeds, the Power Tip is actually cooled by the richer air-fuel mixture to check dangerous pre-ignition caused by overheated spark plugs.

Ask your dealer to install a set of Auto-Lite Resistor Spark Plugs with Power Tip in your car *today!*

*Power Tip is ignition-engineered for overhead-valve V-8's and for most overhead-valve 6's in all these cars: Buick, Cadillac, Chevrolet, Chrysler, De Soto, Dodge, Ford, Hudson, Imperial, Lincoln, Mercury, Nash, Oldsmobile, Packard, Plymouth, Pontiac, Rambler, Studebaker.



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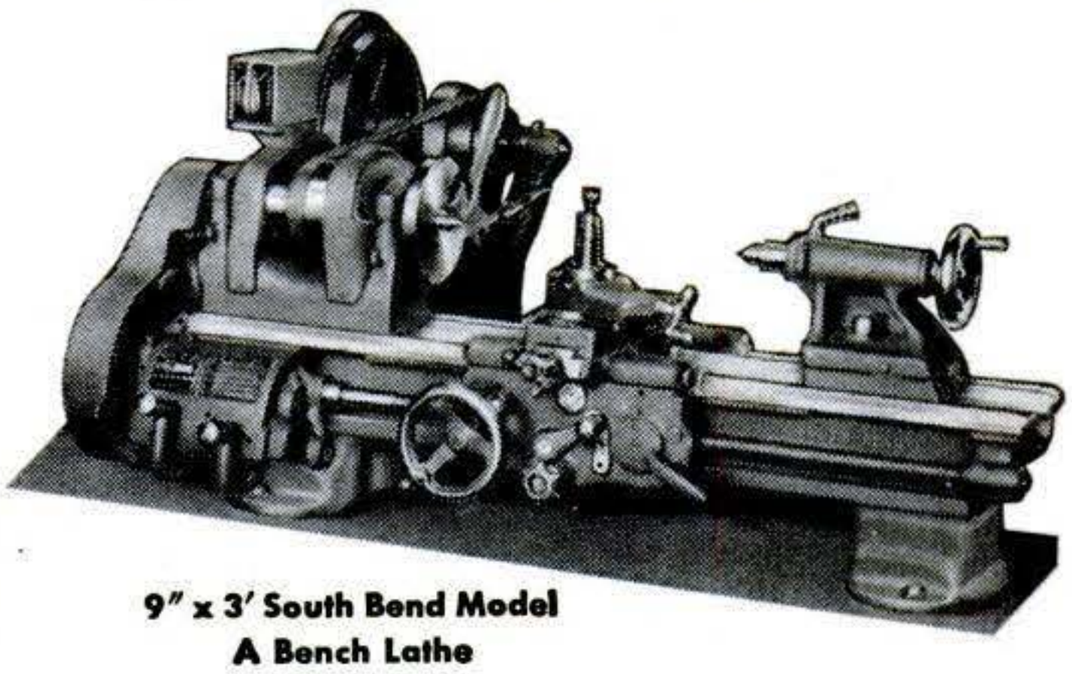
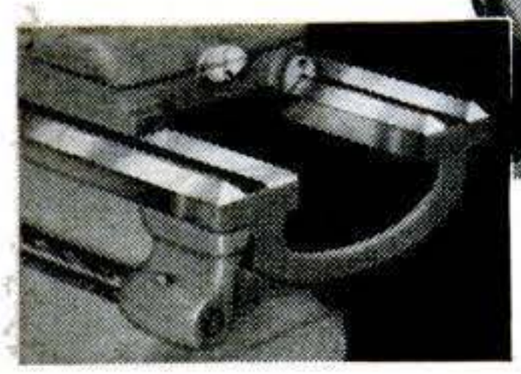


9″ x 3′ South Bend Model A Bench Lathe

16″ x 6′ South Bend Toolroom Lathe



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FREE NEW CATALOG
Describes 9″ to 16-24″ Lathes; Turret Lathes; Vertical Mill; 7″ Shapers; 14″ Drill Presses; Pedestal Grinders. Ask for Catalog 5700.

PRICES f.o.b. South Bend, less electrical equipment:

9″ x 3′ Model C Bench Lathe	$ 276	16″ x 6′ Engine Lathe	$2350
9″ x 3′ Model A Bench Lathe	444	16″ x 6′ Toolroom Lathe	2930
10″ x 3′ Engine Lathe (floor)	1221	13″ x 5′ Turret Lathe	2438
13″ x 4′ Engine Lathe	1595	20″ x 20″ x 20″ Vertical Mill	1742*
13″ x 5′ Toolroom Lathe	2139	7″ Bench Shaper	573
14½″ x 5′ Engine Lathe	1975	14″ Bench Drill Press	127
14½″ x 5′ Toolroom Lathe	2504	10″ Pedestal Grinder	270

*Includes 3-phase motor and control

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21. Iron	30 Mg.
22. Copper	0.45 Mg.
23. Manganese	0.5 Mg.
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25. Iodine	0.1 Mg.
26. Potassium	2 Mg.
27. Zinc	0.5 Mg.
28. Magnesium	3 Mg.
29. Alfalfa Powder	5 Mg.
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31. Parsley Powder	5 Mg.
32. Zein Powder	5 Mg.
33. Soy Bean Powder	5 Mg.
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Compare the richness of this Remarkable Formula With Any Other!

THOUSANDS REPEAT THE SAME STORY—

"I'm LIVING Again!"

Here are just a few typical excerpts from the thousands of letters people wrote us.

I have been taking my Dr. Parker Caps since the first day I received them and I feel like a different person. I don't have that tired feeling thanks to Dr. Parker. — *O. M. F., St Petersburg, Fla.*

I could never tell you all the different ways your vitamins have helped me. I am feeling better than I have in years.—*Mrs. H. T., Woodland, Cal.*

I took half a dozen kinds of vitamins and none helped until I saw your ad in the paper . . . At the end of 20 days I had more vim and vigor than I have had in years.—*W. H. W., Youngstown, Ohio*

More than pleased with the results . . . feel better than I have for 20 years. — *H. M., Collinsville, Ill.*

How the Dr. Parker Plan Operates to Save You Money

When you receive your free 30-day supply of Caps, you are under no obligation to buy *anything*. With your Caps you will also receive a handy postcard. If after taking your free Caps for three weeks you are not satisfied in every way, simply return the postcard and that will end the matter. Otherwise it's up to us to see that you get your next month's supply of Caps on *time* — and at the low, money-saving price of only $4.75!

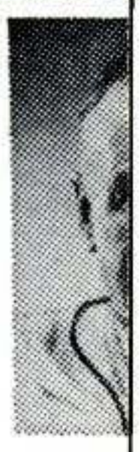
THERE was nothing really wrong with me—except f constant feeling of tiredness that was spoiling enjoyment of life. My friends could easily see that I rundown and worn out. One of them even took me asi and though I showed no severe symptoms of any l he advised me to see a doctor. After a thorough ch my condition was diagnosed as a common nutriti deficiency—frequently seen in our modern way of *even in people who eat "three square meals a day.*

I told my doctor that I had seen a Dr. Parker ad, asked him about the formula. He said it was just wl needed, and so I sent away for the free 30-day trial ply. Now I'm really living again! My tired feeling ha

FREE 30 D

HIGH POTENCY TO

Each Dr. Parker Tonic Cap includes 36 ess gredients, among which are Vitamins A, D, B_2, B_{12}, and 29 other minerals and nutrition



Just fill in and mail the postcard, and get FREE—a 30-day supply of Dr. Parker's Vitalizing Tonic Caps. Discover how this famous *super* high-potency formula may bring you new, youthful vigor, energy and zest for living—even if ordinary vitamin products have failed.

It's no wonder Dr. Parker's Tonic Caps can probably do more to give you new pep and energy, a glorious new "lease on life"—than any ordinary vitamin preparation. Each Cap provide 3 times the minimum adult daily requirements of Vitami 10 times the minimum adult daily requirements of B1; Vitamin B12; Folic Acid; Inositol; Choline—PLUS 28 building Vitamins, Minerals, Enzymes and *natural* nu tors . . . a Time-Tested Formula that has already helpe —offered by a respected company selling quality produ than a century.

Amazing Plan Saves You 50%

Send now for your FREE 30-day supply of Dr. Parke Tonic Caps—worth over $10.00 at retail. With your free v receive full details of Dr. Parker's Health Plan that provi a *fresh* supply of Caps each month for only $4.75—a s 50%. But there's *no obligation* to continue with the pl anything from us *ever!* To help restore that wonderful f *and vitality* you would like to have—mail the postcard

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